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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Railway Reasoning.

The part played by the railways in the industrial life of Great Britain has never been a small one, nor has it been in any way diminished by the amalgamations that have taken place of recent years. Moreover, we are and must be concerned with the railways both as consumers and as producers; as consumers in so far as we use the services of the railways, and would find it difficult to conduct our business without them; as producers in so far as they purchase from us annually an enormous quantity of goods, raw materials, semi-manufactured, and manufactured. Pronouncements by those high up in the world of railways therefore are regarded in many quarters as being second only in importance to similar pronouncements among the bankers, not to mention the fact that they are frequently of more direct and obvious interest. Hence the significance of Sir Josiah Stamp's remarks not long since at the annual meeting of the London Midland and Scottish Railway—remarks which gain in force and in importance from the personal esteem in which the speaker is rightly held. The President of the line spoke in particular of the importance of scientific research and of the steps that were being taken by the company to support it. The amalgamation process, to which we have already referred, had brought under one control, he said, a number of laboratories undertaking separate pieces of work of various kinds—testing materials, metallurgical research, and so on. The company also had some measure of contact with outside research organisations. In order to ascertain the best lines for future development and co-ordination, a committee was formed, as a result of whose findings a director of scientific research has been appointed in the person of Sir Harold Hartley, F.R.S. The interesting feature, however, is that the President's own view has been emphatically confirmed, and it is agreed that both internal and external research has its part to play. The work being done by the railway's own staff and laboratories was found by the committee to be of a high quality, but it was also advised that contacts with other organisations for industrial research, notably the research associations, should be established and strengthened. The new director of research is to be assisted by an advisory committee, and the personnel of this committee speaks for itself:—Prof. Sir Harold Carpenter, F.R.S.; Sir Herbert Jackson, K.B.E., F.R.S., of the Scientific Instrument Research Association; Mr. W. Rintoul, of Imperial Chemical Industries, and Dr. F. E. Smith, F.R.S., of the Department of Scientific and Industrial Research.

When one of the leading railway companies publicly gives its blessing to research, both private and co-operative, on such an occasion and in a manner so intimately associated with its policy, then the future of research begins indeed to look encouraging.

Tradition and Modernism.

A splendid tradition is of infinite value, in that it constitutes a criterion of merit. But it should never be regarded as the apex, but rather as a tried and solid foundation upon which to build anew; a standard not merely to be maintained, but surpassed. Too often it has proved an effective check upon progress—a fact confirmed by the history of the Chinese whose ancestor-worship postulated: "What was good enough for our forefathers is good enough for us."

Tradition is composed of things tested by time and experience and found trustworthy, and those who cling to it too closely are apt to view with acute suspicion and even animosity new departures from the orthodox specifications of the past. In matters of art, this prejudice may be pardoned; in matters of science it is folly, for whilst art deals with such abstract qualities as beauty and imagination, science is concerned only with concrete fact.

To regard science as final is to deny *ab initio* the possibility of any future progress. But science is not, and will never be, final. The more extensive and profound our knowledge becomes, the more is it impressed upon us that our ignorance is of an unrealised depth. In the light of modern thought, however, ignorance represents to us a vast amount of latent knowledge, and that knowledge cannot possibly be absorbed by clinging to tradition.

Adherents to the "old school" have a certain reputation for being conservative and exclusive. That reputation is not one to be openly boasted with pride; rather is it a notoriety which calls for immediate dispersion. Prejudice in favour of methods and plant of a past generation prevents them from testing and considering *with an open mind* modern and improved practice and developments. Thus, unconsciously perhaps, traditionalists admit themselves to be inferior to their forefathers.

There is a saying that "without progress one goes backwards; one cannot stand still." The meaning is ambiguous. When progress stops, in material matters one merely falls behind competitors; plant becomes obsolete; improvements in quality and increase in production cease; one stands still whilst others advance. Mentally, one does "go backwards," in that the research and inquiry inaugurated by predecessors has been abandoned. Unless that active search for new knowledge is continued, then the men of the present day are of less value to industry than their forefathers were fifty years before.

Science is the very last subject in which prejudice should have power to reject or condemn without trial or consideration. Science has reached its present eminence not by fads and fancies, but by creative thought and critical reasoning. Until "some new thing" has been subjected to suitable tests, and facts or figures are forthcoming, one is perfectly just in withholding a decision. When those facts and figures are obtained and made known and, being weighed in the balance with those of similar existing data, are not found wanting, then a fair decision is demanded and should be given. When that decision is withheld, a blow is aimed at the very roots of progress.

In science, as in art, there has always existed an adventurous group of modernists or advanced

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thinkers, and always they have been persecuted with destructive and prejudiced criticism. When living, their greatness is denied entirely; when dead their genius is not disputed. Yet they are the votaries of science and without them the stream of research and progress would rapidly become stagnant.

The twentieth century is an enlightened age, yet in the foundry industry there persists much evidence to deny the statement. In some foundries there exists an ancestor-worship akin to that of the Chinese. A founder uses no other melting unit than a bottle-necked old boiler-casing for the simple reason that "his father used the bottle-neck and made good castings, so why shouldn't he?" In connection with this is the unreasonable prejudice against the modern and efficient electric, pulverised or oil-fired furnace.

An infinite number of examples might be cited of a small founder using a certain mixture because his grandfather and father used it, not because that mixture is pre-eminently suitable for his work. Of a slightly different character and even more numerous are those such as the moulder clinging to a worn-out tool because "it suits him better than others." Another fails to adapt himself to a piece of modern equipment, and, consequently, works beside it without availing himself of its advantages.

The ideal scientist would be one who, so far as his prejudices were concerned, was inhuman when engaged upon his work. Founders, unfortunately, too often demonstrate the truth of a Stoic proverb: "Men are tormented by their opinions of things rather than by the things themselves." It is essential for the advancement of industry that these two views should in some measure be reconciled.

Scottish Foundrymen Visit Clyde Foundry.

On May 8 members of the Scottish Branch of the Institute of British Foundrymen accepted the invitation of Messrs. Harland & Wolff, Limited, to visit their Clyde foundry at Govan, Glasgow. The members were received by Mr. J. Wallace, the general foundry manager, and Messrs. Young and Touchings, assistant managers. The foundry, which is the largest in Britain, is 800 ft. long and 600 ft. wide, divided into six bays. The members, after being conducted round the foundry in small groups, each in charge of a member of the staff, were permitted to inspect in detail anything in which they were particularly interested. Castings are produced in the Clyde foundry varying in weight from a few ounces to fifty tons.

At the conclusion of the visit the Branch-President, Mr. H. Winterton, proposed a vote of thanks to the directors of Messrs. Harland & Wolff, Limited, for having granted permission to the members to visit the foundry, and to Mr. Wallace and his staff for the efficient manner in which the visit had been organised. He said that the occasion would certainly be regarded by most of the members as a red-letter day in the annals of the Branch, as a visit to the Clyde foundry had been eagerly anticipated. They had been privileged to see the finest-equipped foundry in Britain, if not in the world. He was sure that those who had visited American works would agree that no better-equipped foundry was visited by the members at the international congress three years ago. He himself had spent much time in American foundries, and had never seen anything to equal the one which they had just had the privilege of inspecting. He asked Mr. Wallace, in the name of the members of the Branch, to convey to his directors their appreciation of their courtesy in inviting them to see the foundry. He also asked Mr. Wallace and his staff to accept the best thanks of the members for the efforts they had made to make the visit so interesting and instructive.

Mr. James Miller, President-elect of the Branch, in supporting the vote of thanks, said that they all would agree that the visit had been one of the greatest interest and that they had been highly privileged in being shown so excellent a plant.

Mr. Wallace, in replying, said that it had been a great pleasure to have the members of the Scottish Branch visiting the foundry, and he would convey to his directors the kind expression of thanks which they had accorded them. The directors would be pleased to learn that they had enjoyed the visit and the opinion of the foundry which had been expressed by the President. Such visits could with advantage be made more frequent, as it was always interesting to compare one's own methods with those of others. It was always possible to find methods which were superior to those one was using. The Clyde foundry was a large plant to keep supplied with work, and work was not so plentiful at the moment as it might be. He trusted that very soon there would be an improvement, so that there would be work sufficient not only to fill his own foundry, but every other foundry in the country. As far as his staff and himself were concerned, they appreciated very highly the vote of thanks which had been so generously accorded. They had been delighted to show them the foundry and to meet so many fellow-foundrymen.

Middlesbrough Convention Fund.

SECOND SUBSCRIPTION LIST.

In our issue of April 17 we detailed a list of subscriptions to the Middlesbrough Convention amounting to £183 19s. 6d. Further subscriptions, amounting to over £100, are listed below:—

	£	s.	d.
Amounts previously acknowledged ...	183	19	6
Subscriptions subsequently received:—			
General Refractories, Ltd.	10	10	0
Cochrane & Co., Ltd...	10	0	0
Staveley Coal & Iron Co., Ltd. ...	10	0	0
Mr. R. J. Blakey	5	5	0
Anderston Foundry Co., Ltd. ...	5	5	0
Jas. Durrans & Sons, Ltd.... ...	5	5	0
Mr. J. E. Mercer	5	0	0
Ridsdale & Co.	5	0	0
Consett Iron Co., Ltd.	5	0	0
Sheepbridge Coal & Iron Co., Ltd.	5	0	0
Wm. Mills, Ltd.	3	3	0
Iron & Steel Industry	3	3	0
Harrison Bros. (England), Ltd. ...	2	2	0
Parson & Colls, Ltd.	2	2	0
British Pigirons, Ltd.	2	2	0
I. & I. Walker, Ltd.	2	2	0
Bradley & Foster, Ltd.	2	2	0
J. Grayson, Lowood & Co., Ltd. ...	2	2	0
Darlington Railway Plant & Foundry Co., Ltd.	2	2	0
Harrison, Whitfield & Co.	2	2	0
North Eastern Iron Refining Co., Ltd.	2	2	0
Marley Hill Chemical Co., Ltd. ...	2	2	0
Coleman Foundry Equipment Co., Ltd.	2	0	0
Mr. T. E. Bashford	1	1	0
Martha Simm & Sons, Ltd. ...	1	1	0
John A. Smeeton, Ltd.	1	1	0
Wm. Olsen, Ltd.	1	1	0
Morgan Crucible Co., Ltd.	1	1	0
Mr. F. P. Wilson	1	1	0
Swan Bros.	1	1	0
Mr. W. Dresser	0	10	0
Total to date	£287	7	6

Donations should be sent to the honorary treasurer, Mr. T. E. Bashford, Hillingdon, South Road, Norton, Stockton-on-Tees, and crossed "Convention a/c."

Random Shots.

Is it only a rumour, or are there among my readers some who see in such modern movements as vocational selection and intelligence tests nothing but another attempt on the part of the amateur to teach the professional his business? The good folk who promise us that such devices will solve all our problems evidently believe that the outsider sees most of the game. A useful adage, that, and one that must have been responsible for more interference and mischief-making than any other since the world began! But I digress! I was about to tell you of the latest intelligence test, owning frankly enough its transatlantic origin. When a fellow comes to see you about a job, you ask if he has a match. If he goes straight to a particular pocket and produces a match, you take him. If he promptly says "No, sir!" you take him. But if he fumbles or hesitates or looks in every pocket in turn, you don't!

* * *

The theory is that a man who doesn't know whether he is carrying matches or not, nor in which pocket he is likely to find them, is unlikely to be orderly and methodical in his work. Maybe they are right. And maybe, again, they are not. Does not the very uncertainty, the thoroughness of the search, show a spirit of helpfulness, a desire to be of service, that has its own place in business life? I wonder, too, what happens if the candidate produces a lighter? Presumably you take him if it lights at the first click; otherwise not!

* * *

And talking of professionals and amateurs, cricket is with us again, and the hearts of the "fans" will be joyful. (Is it done, incidentally, to talk of cricket "fans"? Or is that expressive word proper only to the talkies, the wireless, and such-like signs of the times?) There are, of course, two kinds of cricket "fans"—or shall we be on the safe side and call them enthusiasts? The first kind make a great point of listening for the day's close of play scores at the end of the First General News Bulletin, and I daresay they will drop in for an hour or two if the Australians should be playing in the neighbourhood. But the others—how better can I dispose of them than by telling the story of that man after their own heart—the distinguished public-school cricketer who was congratulated on his performance, and replied modestly: "Well, it will give father a leg-up"—"father" being at that time a lesser Cabinet Minister!

* * *

I am not in the habit of discoursing on controversial topics, whether domestic or international, but I must admit that there are times when I am hard put to it not to do so. The matter is relevant because I have this week been studying some figures that touch upon at least two such topics. They related to the movements of German exports and imports, and I think the facts are of importance, even if the implications are debatable. According to these statistics, German exports to the creditor countries—U.S.A., Great Britain, France, and Belgium—are steadily rising in value, while German imports from those countries are falling. Where Great Britain is concerned the proportion of the total remains the same, but the actual figures follow the general tendency. At the same time, Germany is increasing her imports from non-creditor countries. The argument advanced is that so long as Germany owes money abroad on account of Reparations, so long must she export more to her creditors than she imports from them—a state of affairs which is not too hopeful for Great Britain since those exports are primarily manufactured goods in direct competition with our own. I am not economist enough to dissect the argument, but I think it is worth a little consideration.

Marksman.

The Effect of Melting Conditions on the Graphite Size and Microstructure of Grey Cast Iron.*

By A. L. Norbury, D.Sc., and E. Morgan, M.Sc.

(British Cast Iron Research Association, Birmingham.)

The Effect of Superheating.

It has been demonstrated by Piwowarsky,[1] Hanemann,[2] Bardenheuer and Zeyen,[3] and others that superheating the melt tends to refine the resulting graphite structure of grey cast iron. Some experiments were made to check this, and micrographs of the results are shown in Figs. 1 and 2. The conditions of melting were as follow:—A 10-lb. charge of Swedish iron (total carbon 3.7, silicon 0.3 per cent.), Armco iron, 40 per cent. ferro-silicon, 80 per cent. ferro-manganese, and 20 per cent. ferro-phosphorus was melted in a fireclay pot in a small high-frequency furnace[4] under a glass slag. As soon as the charge melted it was stirred with a steel rod (the high-frequency current causes a circulatory movement similar to convection currents in the molten metal, which assists thorough mixing), and when the temperature reached 1,290 deg. C. a set of test-bars was cast. The charge was then heated to 1,360 deg. C. (this took about 10 min.), and a second set of bars was cast; it was then heated to 1,650 deg. C. (this took about ½ hr.), and a third set of bars was cast. The analyses of the 0.875-in. dia. bars in the first and last sets are given under Figs. 1 and 2. It will be seen that during the superheating the

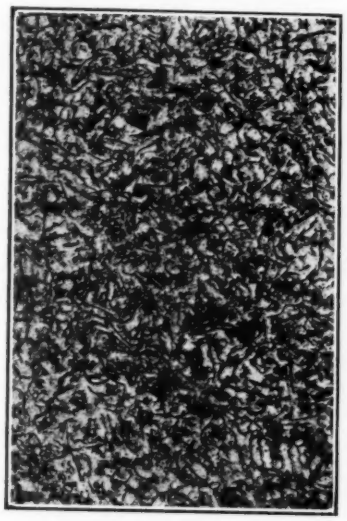


Fig. 1.

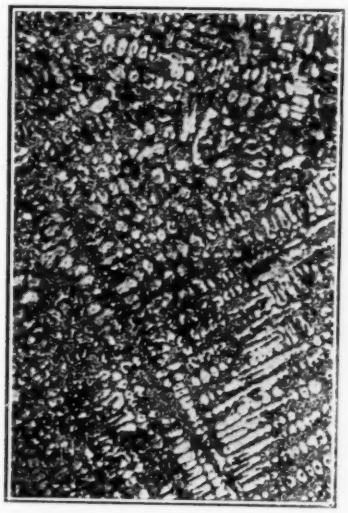


Fig. 2.

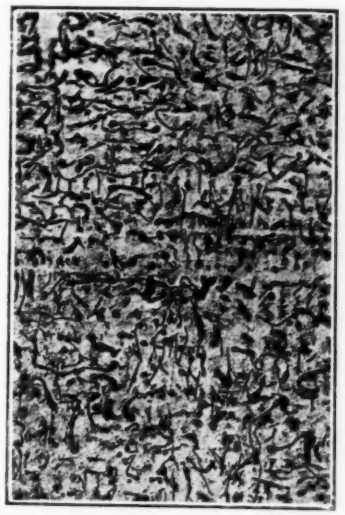


Fig. 3.

Fig. 4.

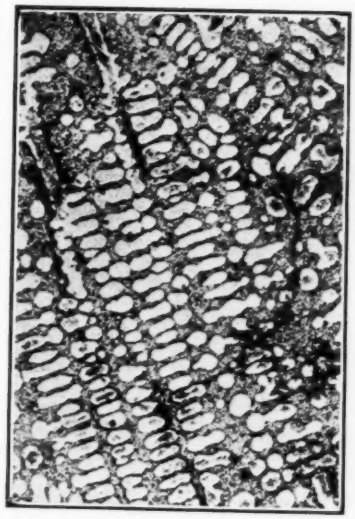


Fig. 5.

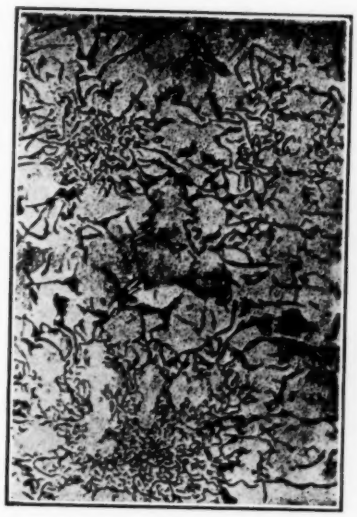


Fig. 6.

Fig. 1.—T.C. 2.79 per cent., C.C. 0.49 per cent., Si 4.28 per cent., Mn 1.05 per cent., P 0.30 per cent. Synthetic mixture heated to 1,290 deg. C. and poured. (0.875-in. dia. bar cast in green sand.) Normal graphite and pearlite, with a little ferrite. Etched. × 50.

Fig. 2.—T.C. 2.55 per cent., C.C. 0.20 per cent., Si 4.46 per cent., Mn 0.96 per cent., P 0.29 per cent. Same melt as Fig. 1, superheated to 1,650 deg. C. in H.-F. electric furnace for about ½ hr. (0.875-in. dia. bar cast in green sand.) Normal graphite and pearlite and supercooled graphite and ferrite. Etched. × 50.

Fig. 3.—T.C. 2.73 per cent., C.C. 0.75 per cent., Si 3.26 per cent., Mn 1.00 per cent., P 0.03 per cent. Synthetic mixture, 40 per cent. ferro-silicon stirred in last. Normal graphite and pearlite, with a little ferrite. Etched. × 50.

Fig. 4.—T.C. 2.79 per cent., C.C. 0.42 per cent., Si 3.26 per cent., Mn 1.00 per cent., P 0.03 per cent. Same melt as Fig. 3, heated at about 1,350 deg. C. for about 2 hrs., and intermittently stirred with steel rod. Normal graphite and pearlite and supercooled graphite and ferrite. Etched. × 50.

Fig. 5.—Same specimen as Fig. 4, another area. Supercooled graphite and ferrite. Pearlite network black. Etched. × 50.

Fig. 6.—Supercooled graphite due to green-sand chilling near edge of bar shown in Fig. 1. Pearlite network. Etched. × 200.

(All specimens, unless otherwise stated, were etched in alcoholic picric acid, and show average structures of 1.2-in. dia. bars cast in green sand.)

* Part of a Paper read before the Spring Meeting of the Iron and Steel Institute.

1 "Transactions of the American Foundrymen's Association, 1929, vol. xxxiv, p. 914.

2 "Stahl und Eisen," 1927, vol. xlvii, p. 693.

3 "Die Giesserei," 1928, vol. xv, pp. 354 and 385.

4 By courtesy of Messrs. Campbell and Gifford, who placed a furnace at the Association's disposal.

total carbon content dropped by 0.24 per cent., the silicon increased by 0.18 per cent., and the manganese dropped by 0.09 per cent. It is probable that at the highest temperatures some SiO_2 was reduced from the pot or the slag by carbon, since considerable quantities of carbon monoxide were evolved from the melt and burnt at its surface. A comparison of Figs. 1 and 2 shows that the graphite was refined, and it will be noted that the fine graphite is associated with ferrite (as found in the previous Paper), which is confirmed by the lower combined carbon content of the superheated bar.

The Effect of Reheating at 1,300 to 1,400 deg. C.

Micrographs illustrating the effect of reheating at 1,300 to 1,400 deg. C. are shown in Figs. 3, 4 and 5. For the purpose, a 50-lb. charge of Swedish iron, Armco iron, 40 per cent. ferro-silicon, etc., was melted in a plumbago crucible in a coke-fired furnace at 1,300 to 1,400 deg. C., and one set of test-bars was poured. A micrograph of the 1.2-in. bar is shown in Fig. 3, where it will be seen that the structure consists of normal graphite and pearlite with only a little ferrite. The combined carbon content was 0.75 per cent. The crucible was then replaced in the coke furnace, reheated for about 15 min., stirred with a steel rod, and a second set of bars poured. The pot was then reheated for 30 min., and a third set of bars poured, for another 30 min. and a fourth set poured, and for another 30 min. and a fifth set poured. The melt was stirred for 1 to 3 min. each time, prior to pouring, with a 1-in. dia. steel rod, some of which dissolved during the process and helped to refine the graphite structure. The refined structure of the fifth 1.2-in. bar is shown in Figs. 4 and 5; it contained about 70 per cent. of the structure shown in Fig. 4 and about 30 per cent. of that shown in Fig. 5, the combined carbon content being 0.42 per cent., as against 0.75 per cent. in the case of the first bar (Fig. 3). The structures of the intervening bars were intermediate between the above. It will be noted that, apart from the combined carbon, the chemical analysis of Figs. 3 and 4 has remained practically unaltered.

Fig. 7.

Fig. 8.

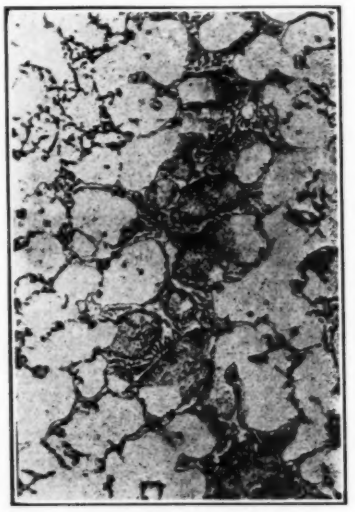


Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 7.—T.C. 3.20 per cent., C.C. 0.37 per cent., Si 3.54 per cent., Mn 1.03 per cent., S 0.07 per cent., P 1.52 per cent. Pig iron as crucible melted and cast. Supercooled graphite, ferrite, and pearlite associated with phosphide. Some normal graphite. Etched. × 200.

Fig. 8.—T.C. 2.84 per cent., C.C. 0.22 per cent., Si 4.48 per cent. (Mn, S, and P slightly lower than Fig. 7). Same melt as Fig. 7 after reheating and stirring in 3 per cent. of 40 per cent. ferro-silicon. Normal graphite. Etched. × 200.

Fig. 9.—T.C. 2.69 per cent., C.C. 0.23 per cent., Si 4.13 per cent. (Mn, S, and P slightly lower than Fig. 8). Same melt as Fig. 8 after reheating and stirring in 3.5 per cent. of steel. Supercooled graphite. Etched. × 200.

Fig. 10.—T.C. 3.46 per cent., C.C. 0.75 per cent., Si 2.26 per cent., Mn 1.00 per cent., P 0.30 per cent. Synthetic mixture, 40 per cent. ferro-silicon stirred in last. Normal graphite. Unetched. × 50.

Fig. 11.—T.C. 3.41 per cent., C.C. 0.77 per cent., Si 2.64 per cent., Mn 1.00 per cent., P 0.30 per cent. Same melt as Fig. 10 after reheating and stirring in 0.6 per cent. of steel. Finer graphite than Fig. 10. Unetched. × 50.

Fig. 12.—T.C. 3.42 per cent., C.C. 0.68 per cent., Si 2.29 per cent., Mn 1.0 per cent., P 0.30 per cent. Same melt as Fig. 11 with about 0.03 per cent. of flake graphite stirred in without reheating. Coarser graphite than Fig. 11. Unetched. × 50.

(All specimens, unless otherwise stated, were etched in alcoholic picric acid, and show average structures of 1.2-in. dia. bars cast in green sand.)

The Effect of Chilling.

Refinement of the graphite structure by chilling is shown by Fig. 6, which shows—at 200 dia.—fine graphite produced on the edge of the bar whose general normal graphite structure is shown—at 50 dia.—in Fig. 1. The bar in question was cast in green sand and contained the fine

graphite-ferrite structure shown in Fig. 6 to a depth of about 0.1 in. from the outside, its formation being due to the more rapid cooling of the outside layers. The interior of the bar contained the normal graphite-pearlite structure shown in Fig. 1. It may be added that the change from the finest to the coarsest graphite was a continuous one, and that a fine graphite outside edge was obtained on bars containing medium-sized normal graphite in the centre, while only a medium-sized graphite outside edge was obtained on bars containing coarser graphite in the centre.

The Effect of Additions of Ferro-Silicon, Steel and Graphite to Crucible Melts.

It was invariably found, when making test-bars from synthetic melts, that if the 40 per cent. ferro-silicon part of the synthetic melt was stirred in last, then normal graphite structures were obtained. This action of 40 per cent. ferro-silicon is confirmed by the microstructures shown in Figs. 7 and 8. In this experiment, a 50-lb. charge of a high-silicon, high-phosphorus pig-iron was crucible melted as before, and the test-bar shown in Fig. 7 poured. The melt was then reheated, 1 per cent. of 40 per cent. ferro-silicon was stirred in, and a second test-bar poured. The pot was then reheated, 2 per cent. of 40 per cent. ferro-silicon was stirred in, and a third set of test-bars poured. The coarsening effect of the ferro-silicon addition on the graphite is shown by a comparison of Fig. 7, which shows a typical area in the 1.2-in. bar cast from the original pig, and Fig. 8, which is of the test-bar cast after the second ferro-silicon addition. It will be noted that the silicon content increased from 3.54 to 4.48 per cent., while the total carbon content dropped from 3.20 to 2.84 per cent. The difference in the graphite structure is not, however, due to the alteration in chemical composition, but to the graphite-coarsening action of the 40 per cent. ferro-silicon addition. The melt was then reheated, 1½ per cent. of steel was stirred in, and a fourth set of test-bars poured, after which it was again reheated, 2 per cent. of steel stirred in, and a fifth set of test-bars poured; the microstructure of the latter, Fig. 9, shows that the steel additions caused a marked refinement of the graphite. It will be noted that Fig. 7, the original pig, contains fine graphite with small amounts of coarse graphite, whereas Fig. 9, after the steel additions, contains only fine graphite. In another experiment, the 1.2-in. dia. test-bar shown in Fig. 10 was poured; then 0.6 per cent. of steel was stirred in, and the 1.2-in. dia. test-bar shown in Fig. 11 poured. Comparison of Figs. 10 and 11 shows the graphite refining consequent on the small steel addition. The chemical composition was not appreciably affected. After casting the 1.2-in. bar shown in Fig. 11, 0.03 per cent. of flake graphite was stirred into the crucible without reheating, and the bar shown in Fig. 12 was cast; it will be seen that this small addition of graphite caused a marked coarsening of the graphite flakes.

The Effect of Silicide Additions to Cupola Metal.

In the following tests additions of 10 per cent. ferro-silicon, 60 per cent. calcium silicide, and 6 per cent. nickel silicide (nickel "F" shot) were made to ladles of iron tapped from a cupola making white-heart malleable containing total carbon 3.7, silicon 0.75, manganese 0.28, sulphur 0.22, and phosphorus 0.08 per cent. Additions of 80 per cent. ferro-manganese were made at the same time in order to bring the manganese up to 0.5 to 1 per cent.

In the first experiment, 1 lb. of 10 per cent. ferro-silicon and 4 ozs. of 80 per cent. ferro-manganese were placed in a red-hot ladle, into which was then run 30 lbs. of cupola metal at 1,380 deg. C. The metal was thoroughly stirred with a steel rod, and a set of test-bars cast at about 1,300 deg. C. The resulting 1.2-in. bar (T.C. 3.67, C.C. 0.96, Si 1.02, Mn 0.84, S 0.21, and P 0.08 per cent.) gave a tensile strength of 13.9 tons per sq. in., which is high considering its total carbon content of 3.7 per cent.

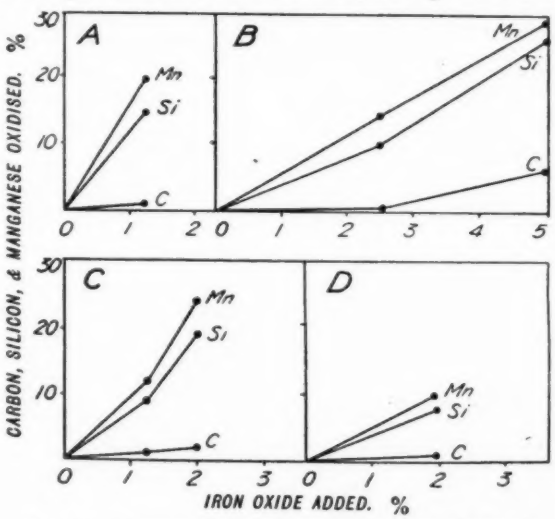


Fig. 13.—Carbon, Silicon and Manganese Oxidised from Grey-Iron Crucible Melts by Additions of Iron Oxide.

In the next experiment ¼ lb. of 60 per cent. calcium silicide and 3 ozs. of 80 per cent. ferro-manganese were placed in a red-hot ladle, and 20 lbs. of cupola metal was run in. The metal was well stirred with a steel rod, but the silicide caked on the side of the ladle, and the analysis (T.C. 3.64, C.C. 1.04, Si 0.92, Mn 0.57, S 0.21, and P 0.08 per cent.) shows that only a little of it had alloyed with the metal. The resulting 1.2-in. bar gave a tensile test of 14.9 tons per sq. in., which again is high, having regard to the high total-carbon content of 3.64 per cent.

In the next experiment ¾ lb. of 6 per cent. nickel silicide (nickel "F" shot) and 3 ozs. of 80 per cent. ferro-manganese were placed in a red-hot ladle, 30 lbs. of cupola metal run in and the metal thoroughly stirred. The nickel alloyed readily, and the resulting cast (T.C. 3.66, C.C. 0.90, Si 0.77, Mn 0.73, S 0.21, P 0.08, and Ni 2.63 per cent.) gave the high tensile strength of 16.8 tons per sq. in. on the 1.2-in. bar.

The Effect of Bubbling N, H, and CO_2 through Crucible Melts.

In these experiments a 20- to 50-lb. charge of Swedish white iron, Armco iron, and 40 per cent. ferro-silicon was melted in a salamander crucible in a coke-fired furnace, and a set of test-bars cast. Gas from cylinders was then bubbled through the melt for several minutes by means of a salamander tube about 4 ft. long, ¼ in. in internal dia., and having walls ¼ in. thick. A second set of test-bars was then cast, and their microstructures and mechanical properties compared with the first set. Bubbling nitrogen through in this manner caused small drops of slag to rise to the surface of the melt, but had no apparent effect on the microstructure or mechanical strength of the resulting test-bars. Similarly, hydrogen appeared to free the melt from slag and give a very clear melt, but had no other apparent effect, nor had nitrogen and hydrogen when bubbled through simultaneously down the same graphite tube.

An addition of iron oxide to a melt through which hydrogen had been bubbled caused a vigorous evolution of a gas, which was possibly steam, since the bubbling was much less vigorous when further additions of oxide were made.

Bubbling carbon dioxide through crucible melts caused the formation of considerable amounts of slag, which formed in the metal and rose to the surface. The slag was probably an oxidation product, such as manganese or iron silicate; it succeeded in freeing itself from the melt and was only visible under the microscope in the top few inches of the test-bars, and their mechanical properties were equal to those of untreated bars of similar composition.

The Effect of Iron-Oxide Additions.

In these experiments, additions of iron oxide, in the form of scale from the annealing pots used in white-heart malleable practice, were stirred into synthetic crucible melts. The iron-oxide additions caused a certain amount of bubbling when they were stirred in, and a considerable amount of frothy slag formed on the surface of the melt. This, however, quickly subsided on stirring. It may be pointed out that the conditions of these experiments were such that any reaction between iron oxide and the carbon, silicon, manganese, etc., in the melt was allowed to proceed to completion. In cupola practice, on the other hand, reactions between oxides and elements in the melt are sometimes still proceeding in the metal in the ladle; bubbles of gases rise to the surface of the melt and burn with a pale blue flame. (Occasionally the reactions are still proceeding in the solidifying casting.) It seems probable that such jets of flame are caused by particles of oxide in the melt reacting with carbon to give carbon monoxide, which then rises to the surface and ignites. It was also noted that, on stirring in the iron-oxide scale, the ensuing reaction evolved a considerable amount of heat, which caused marked incandescence in the melt. Moreover, the melt became very thick after such additions, but on further heating or stirring the suspended particles slagged together and rose to the surface. The percentages of manganese, silicon and carbon oxidised from the melt in the above manner are shown in Fig. 13, where it will be noted that the manganese is more rapidly oxidised than the silicon, and the silicon more rapidly than the carbon, under the conditions of the present experiments. It is not possible to make any other deduction from the results, since the scale additions were not weighed accurately.

Coal well stacked weighs approximately ½ cwt. per cub. ft.; loosely stacked approximately 50 lbs. per cub. ft.

Japanning Iron Castings.—The casting to be treated should be quite clean and free from sand. It should then be coated with good quality boiled oil and allowed to stand until the surplus oil has drained off and the surface of the casting is practically dry. The next operation is to place the casting in a stove (as airtight as one can reasonably expect), and heat gradually until at length the surface of the casting becomes black. It should then be allowed to cool off gradually, and if the method has been carefully followed a good black polish should be obtained.

The Mechanisation of Foundries.

Mr. G. E. France's Paper, bearing the caption "The Foundry is a Machine," which was printed in our issue of May 1, was presented before the Lancashire Branch of the Institute of British Foundrymen, where it gave rise to an interesting discussion, the more important parts of which are extracted below.

Minimum Requirements for Mechanisation.

In proposing a vote of thanks, Mr. C. W. Kent asked what was the minimum tonnage of castings which, in Mr. France's opinion, would warrant putting in plant for continuous or semi-continuous casting. Had Mr. France experience of such plant in a foundry producing castings to material specification? He understood Mr. France to say, when mentioning sand-mixing, that the amount of new sand was so small that there was no necessity to make provision for the storage of it. Was that so?

Effect of Breakdowns.

Mr. Grundy, in seconding a vote of thanks, said Mr. France had dealt with the subject very efficiently and given information of very great interest. Fig. 1 showed a conveyor dealing with the output of that special casting. By the old method, Mr. France stated, probably 250 castings per day were made and 50 tons of sand used. By the new method 500 castings were produced and only 9 to 10 tons of sand used. This meant the same sand was re-used at least five times. Did any trouble occur through hot sand?

When considering mechanical sand-handling plant one naturally thought of the inevitable wear and tear of the machines, and he would like to know what time was lost through breakdowns, and, where the plant was a central one, what happened to the foundry whilst the plant was being repaired.

Continuous Castings Meet Specification.

Mr. France said that the question of what minimum tonnage warranted continuous casting could not be answered definitely. The practicability of such a system depended entirely upon the conditions in each individual case—the type of casting, the value, the local circumstances. Conceivably continuous casting might be justified in a particular case where the output was 5 tons per week; in another case with an output of 1,000 tons per week it might not be advisable. Each job must be taken on its own merits. In one instance with which he had been dealing, the production was only 12 tons per day. That was a very simple example of a continuous-casting system about which there was nothing elaborate. When it was necessary, for example, to install machinery for the preparation of new sand it was a different matter. He did not feel justified in giving a figure as the quantity of castings which would justify continuous casting.

In his experience he had not known a case where a continuous-casting system was put in definitely for the production of castings to meet a material specification. But there was no reason why the system should not be applied; in fact, to the contrary, because in such castings every effort should be made to reduce the variable factors and to standardise the procedure.

Sand Problems Solved.

A point was raised about new sand. He ought to have pointed out in a slide which showed facing sand coming from two machines in the same plant, that the only provision made there for storage of new sand was a small heap underneath the central hopper. Experience had shown that the amount of new sand was so small as not to justify capital expenditure on storage, or mechanical handling, to take care of it. But obviously, if plant was put in to deal with 500 tons of sand, mechanism would be needed to deal with the new sand.

A very material point was raised by Mr. Grundy—about hot sand. In the job to which reference was made the time occupied by the cycle of operations from making the mould to knocking out the finished box was 15 or 20 minutes. On that particular job long and extensive tests and investigations were made to ascertain the actual length of time that was necessary, and it was found to be about 15 minutes. The bulk of the sand had no opportunity to become really hot in the first place, and cooling went on in the passage of the sand through the various processes. That was quite sufficient to reduce the temperature of the sand to a reasonable degree.

Another material point was the possibility of failure of mechanical devices. The designers and suppliers of foundry machinery deplored the lack of its appreciation among average foundry workers, many of whom apparently did not realise the importance of proper lubrication and the need to keep a careful control upon the equipment. Under such conditions the factor of safety must be very large and every endeavour made to make the plant fool-proof. He could say, quite definitely, that 90 per cent. of the complaints received of failure of foundry machinery were due to lack of lubrication. That would disappear when users realised fully that the machinery required reasonable care. The worst possible conditions for machinery existed in the foundry, and that fact alone ought to ensure that foundry machinery should at least receive the same care and attention as that given to machinery in the machine shops.

Jobbing Shop Conditions.

Mr. R. W. Stubbs said he had followed the lecture with great interest and thought he had gained a considerable amount of knowledge from the various slides. They had been shown mechanical moulding on a large scale; it looked like the realisation of a foundryman's dream. But could this system of continuous casting be adapted to a jobbing foundry where only threes, sixes, eights or tens were being made, and the work was constantly changing? Also it seemed to him in the average foundry the cost would be prohibitive. Again, the average foundry would not have enough work to keep it fully employed.

Reducing Labour Costs.

Mr. France replied that because he had shown a simple example of a continuous-casting system dealing with one casting, repeating it over and over again, it must not be imagined that the system could not be adapted to a jobbing foundry. Each case must be taken on its merits. Even assuming investigation showed that it was not economical or expedient to adopt it in a particular case, advantages might be gained by the introduction of some of the combinations which made up the continuous-casting system. One instance had already been illustrated. Before that plant was installed 180 tons of material had to be moved to produce one ton of castings. That figure was brought down to 77. That must represent a considerable saving in the labour charges. The central handling plant, for example, cost approximately £2,000; in one year nearly £800 was saved in the cost of sand and £200 in the cost of iron. For four years it had been producing 20 tons of sand per hour regularly. He was speaking now of backing sand, which was delivered of uniform consistency to the moulders. Previously the moulders were in the habit of blaming the sand when anything went wrong; that excuse was no longer available. The actual saving more than paid for the machine in a very short time.

He had shown an illustration of a small plant where a man was shovelling sand into a rotary screen. That particular plant showed an unexpected saving by reducing the quantity of discarded sand, the saving in handling, transport and tipping of which helped considerably to recoup the cost of the plant.

Mr. Stubbs asked whether there was any limit to the size of castings which could be dealt with.

Mr. France said in this particular case the weight of the castings was 50 lbs. each. But there was no limit or at least the limit was fixed by the moulding machine.

Cycle Times.

Mr. Pell said an illustration showed a crane-ladle used for casting 50 lbs. weight. Twenty-five boxes per hour were produced, two castings, each of 50 lbs., being in each box. The cycle of operations from leaving the cupola to knocking out at the grate occupied 15 min. Suppose a box of similar size was used for castings weighing 6 or 7 lbs. each. Five or six boxes could be cast with a 40-lb ladle. The hot metal must be delivered much more quickly to cast properly.

Mr. France replied that the cycle of operations mentioned applied in that particular case, but in another job it might differ. The rate of delivering the metal or the time elapsing between pouring and knocking out would, of course, be fixed with regard to the particular job.

Sand Renewal.

The Branch-President (Mr. Longden) said the statement that 5 per cent. of new sand was added to the re-conditioned sand might be misunderstood. It had reference to the whole of the sand used and not to facing sand only. Five per cent. of the whole of the sand would represent a very much larger amount of new sand, perhaps about 40 per cent. if used for just facing sand alone.

Mr. France said in the particular example under discussion no facing sand was used. The sand, which was constantly circulating, was all that was necessary for that particular job. Very often it was found that sand which passed through a central sand-handling plant, or re-conditioned sand, with a very slight percentage of new sand, was equivalent to the facing sand used on the majority of jobs. That was another point in favour of continuous sand treating, that in many cases it cut out the need for facing sand.

Mr. A. Jackson pointed out that under the ordinary system only badly-burnt sand and sweepings was discarded; with machine handling and knock out, all sand remained at the same consistency. Hence the 5 per cent. thrown away was good sand. What happened to the sand which was replaced by the addition of 5 per cent. of new sand?

Mr. France replied that the 5 per cent. was required to meet the loss of sand which did not go back into the system. For instance, some of it stuck on the castings.

The Branch-President said some foundrymen were given to understand that by introducing sand-mixing plant they could reduce considerably the amount of new sand required. That was a fallacy; it was a misunderstanding of the service given by such plant and had led to disaster in many cases. Continuous sand-mixing plants were specially adaptable to mass production.

Mr. France said even if new sand was not required some sand would have to be added in order to make up for the leakages.

Over-Printed Blue Prints can be made reasonably clear and quite readable if dipped in a concentrated solution of cold tea and water. Good results can only be attained providing the print has not been previously in the water bath and afterwards allowed to dry. The print may also be sponged instead of dipped, and in this case a quart bottle of the above solution would last for months. Keep the bottle well corked when not in use. The tea should not be too strong or too much tanning will take place and cause the print to fade in after use.

Jobbing Moulding.

Members of the West Yorkshire Branch of the Institute of British Foundrymen recently inspected the foundry of Messrs. Carrick & Foster, Castlefields Iron Works, Bingley, by kind invitation of the firm. The visitors were welcomed by Mr. R. Carrick, managing director, and were shown over the plant, which is devoted to the production of light castings, especially rain-water goods. After the visit the party, accompanied by Mr. Carrick, adjourned to a neighbouring school for tea, as guests of the firm. The thanks of the party for the firm's hospitality were voiced by Mr. H. Sayers, of Leeds (senior Vice-President), seconded by Mr. S. W. Wise, the honorary secretary.

After the meeting, Mr. A. S. Worcester, of Huddersfield (junior Vice-President of the Branch), gave a more or less spontaneous talk, aided by blackboard diagrams, under the title of "Some Notes on Jobbing Moulding."

Jobbing Work Neglected.

MR. WORCESTER suggested that there was a tendency nowadays to neglect jobbing work to a degree which he hardly thought was altogether justified by conditions in the trade. On looking back over Papers given before various branches of the Institute, there was not really much given on jobbing practice, although he agreed most of what had been given and published for specialised work could be in some way applied to jobbing. One could not get away from the fact that a great many jobbing foundries still existed, and he could hardly visualise the time when they would not be required. On the question as to what could the Institute do to help the jobbing foundry, it had to be kept in mind that practically all materials were obtainable by all founders, and there seemed only to be left the question of ways and means of using those materials to the best advantage. This question boiled itself down to two items—tackle and craftsmanship, two items which, to his mind, were distinctly open to help through the meeting together and pooling of experiences and knowledge which became possible through membership of the Institute. There were undoubtedly many little useful tips and arrangements which one member could introduce to another, and ample scope for craftsmanship still to rise on to a higher plane. He thought practically all members could have something to put into the pool on this matter, and probably all could take something out.

Tackle and Boxes.

Mr. Worcester proceeded to speak of lifting tackle and box parts, and enumerated a few useful boxes of various sizes which could usefully be made without bars or handles, using lugs. He also suggested that a good rustless box would be of great advantage, and should prove a sound commercial proposition. Points to be considered when making boxes, the disadvantages of pins and the snap flask were briefly described. He went on to outline the various tackle used in jobbing foundries, including that for bolting down, for loam and strickle work and for lifting. One of the most useful for lifting was the beam and roller chains, as this could be employed for many different miscellaneous objects. Craftsmanship, however, was the biggest factor in the jobbing foundry, and the length of time spent on moulding supremely important. Many jobs were ruined by the moulder doing too much; bottoms were rammed too hard, and there was too much sleeking of the face; these, together with an excess of plumbago, lifters and sprigs, were often the cause of innumerable wasters. Mr. Worcester gave a large number of useful "Don'ts," particularly referring to the usage of the vent wire, ramming, lifters and sleeking. Oil and plumbago mixed together is excellent for sealing dry-sand joints. With the smaller work, it sometimes paid to make a plaster mould from original patterns, using this as the pattern. The author dealt with the subject of mixing the plaster and other matters, such as pattern-plates and the use of plumbago as a facing for plaster work. The running and rising of jobs constituted a difficult problem, and the ordinary small jobs can generally be run clean, working on the fact that scum is lighter than iron. In conclusion, the speaker described the method used for dealing with one job, that of a 15-ft. rope-wheel split.

DISCUSSION.

A Useful Pattern-Plate Arrangement.

The PRESIDENT said he had been a little surprised to hear Mr. Worcester suggest that a 64th was sufficient clearance. With regard to the best method of pinning boxes and the holes in boxes, he (Mr. Thornton) found rather a good method was to cast the lug of the box with a cored hole and have a jig over the centre of the holes, with a pin in, and run that up with white metal. One had to make it secure that the metal did not get out of the joints and cover the hole up with sand. These bushes would last very well. When they were worn, it was easy to get a whole lot of boxes and run them all up again. Mr. Thornton said he had had considerable trouble with warping of steel boxes, but there was a new section which was much stiffer and a very good section for keeping straight, and helped to hold the sand in. He was rather surprised to hear any suggestion of use of cast-iron trunnions, and certainly agreed with Mr. Worcester that steel ones were better. He had been a little surprised, also, that Mr. Worcester did not speak more about the built-up box, which was very useful for a jobbing foundry. One could make the sides on the floor very cheaply and build any size of box required with the use of standard sides and standard core box, and make bars to fit the job. Turning to semi-repetition work, a good arrangement was a template for the patternmaker in the form of a cross, big enough to suit all the different sizes of plates, and with standard holes drilled every 2 in. along the lines of the cross.

Spraying Preferred to Sleeking.

MR. W. PARKER (Halifax) said, in regard to wet blacking of dry-sand moulds, he had adopted a method of finishing the moulds, spraying on the blacking and gum-wash. Spraying reached into the pores and gave a good surface and obviated the time taken by sleeking off, which may cut the moulds. Many repetition lines came in occasionally for jobbing work. He had found one could do a quantity of dry-sand work by putting in brass bushes and running them in with metal, and they would last six months or so without the metal running out. These bushes had to be relined about every 18 months.

MR. H. HARRISON (Bradford) said he liked the idea of the double lug boxes with pins. Personally, he thought they were the best thing there was in a foundry. The box was easily picked up and taken from one job to another, and there was no twist. In regard to wet blacking and dry sand, personally, he would rather half-finish a job and sleek the blacking. (MR. PARKER: I question that; I have just cast one of 12 tons and it is very good. We have not the skilled moulders to-day for smoothing blacking.) Mr. Harrison, continuing, said he thought with small interchangeable boxes, instead of having the ordinary flat bar at the bottom, it was well to have the bar upright instead of flat; it would do for a top at any time. In regard to the foundry generally, he was strongly of opinion that there was widespread need for better system in working, and particularly for having everything in its place.

MR. H. SAYERS agreed with the President in saying he would not like to work under a box with cast-iron trunnions or swivels.

Author's Reply.

MR. WORCESTER, replying to the comments of members, said in regard to Mr. Parker's remarks on the blacking of moulds, for ordinary machine-tool work he would sooner work with a green sand and then coating with blacking put on with a sprayer, but for heavy engineering castings having 3- or 4-in. sections a sleek blacking was preferable. A fairly friable facing sand with a thin coating of blacking did not require sleeking. For pin holes in boxes, undoubtedly bushing with white metal was one of the best methods to employ, especially for the loose pins. Mr. Worcester agreed with Mr. Harrison's suggestion of having the bar upright instead of flat, but if one had any plated jobs with a fair amount of air and very little joint, one was liable to be up against it in the bearing on the bottom if one had nothing to put on it, and the edges of the bars would show through the face if the edges were too near. In regard to cast-iron trunnions, he was by no means enamoured of them, and had certainly seen some alarming samples up and down the country. Two important points in jobbing were, how much will a job weigh and how much would hold it down. Neave, in his "Moulder's Ready Reckoner," gave a system which, even if it was many years old, was still a good one—the area of the job in feet multiplied by the height in inches by a constant of 40 was the weight required in pounds.

MR. SAYERS, referring to spraying, asked if any member had come across a really satisfactory hand-sprayer. One had been demonstrated at his foundry recently, but it had jammed, and it seemed to be very difficult to find one that was reliable.

MR. WORCESTER: Ordinary compressed air is a very good sprayer.

MR. SAYERS: Yes; but I am thinking of the man who may not have compressed air available.

A MEMBER advocated round corners for boxes instead of square, and said he had never had a break with these.

MR. WORCESTER: I quite agree. Generally speaking, the round corners were much stronger than square.

Vote of Thanks.

MR. R. CARRICK (of Carrick & Foster, Limited), moving a vote of thanks to Mr. Worcester for his talk, said discussion on these various aspects of jobbing work could go on a very long time, with considerable profit to all concerned. Despite all the changes in foundry life and methods in the last twenty years or so, there still remained—he was glad to believe from the nature of that afternoon's discussion—a good deal of sound common sense in foundry ideas. The Paper was one on common-sense methods, and the discussion had been maintained on similar lines.

Costing and Price Cutting.

During the past ten years or so quite a lot of what one might call jobbing foundries had gone out of existence, though he admitted quite a lot remained and seemed to be doing quite well on up-to-date methods. The great fault amongst jobbing foundrymen who had set up for themselves and had to give up, was not their lack of energy or of skill or common sense so much as, usually, their lack of sufficient commercial instinct to grasp the great question of costs. That was an essential side to any business to-day, and the most capable of foundrymen could not hope to run a business successfully without it. The policy of trying to overcome a lack of business methods by price-cutting was one which could only lead to one unfortunate end. So far as concerned workmen, Mr. Carrick thought the industry had to-day, speaking comparatively and generally, as good a quality of workmen as in any other section of the engineering trades.

(*Continued on page* 366.)

Efficiency in the Core Shop.*

By Frank Hudson.

Efficiency in the core shop can be best exemplified by the word "core" itself. C stands for cost, O stands for output, R for the results obtained, and E for efficiency. Efficiency as fixed by one foundry in many cases does not hold good for a neighbour, as the type of castings being made is the determining factor. Thus, cores for certain classes of castings must be exceptionally hard to withstand rubbing to gauge size and jointing as required for intricate heavy engine work, or exceptionally strong as is required for the mass production of small stove-plate work. This calls for the use of increased binder percentages and increased core cost over general jobbing work, yet the efficiency may be high. On the other hand, it is not good practice to aim for too hard and strong cores when the type of casting does not warrant their use. Many foundries consider that the initial cost of oil sand precludes its use. Cost alone does not give efficiency, and it is as well to remember that in many foundries efficient oil-sand core practice has proved the key to modern mass production methods. It is quite an impossibility to treat with every point bearing upon efficient core-room practice in a Paper of this nature, so it will be necessary to limit remarks to generalities. At the same time, it will be appreciated that to describe these generalities, in a simple and understandable way, is not an easy matter. At the Birmingham Branch dinner one of the guests, Mr. Smith, of South Shields, in giving the toast to this branch, made a plea for more practical Papers, and the idea was born to the author that much could be accomplished in this direction if the main facts could be brought out in an easily-assimilated manner. All value the knowledge obtained by works visits, so it is proposed, instead of presenting dry reading matter, to chaperone readers round the core shop of a fictitious foundry. Naturally, those points of general interest will be stressed most and specialised practices omitted. The foundry to be visited can truthfully be called "The Future Foundry Company (1950), Limited." It is said that this foundry has not produced one bad casting in the last 5 years, so perhaps one will learn how this is done. Assuming all are assembled in the Future Foundry's core-shop annex, where the core sand and other core-making materials are stored, the following is to be noted.

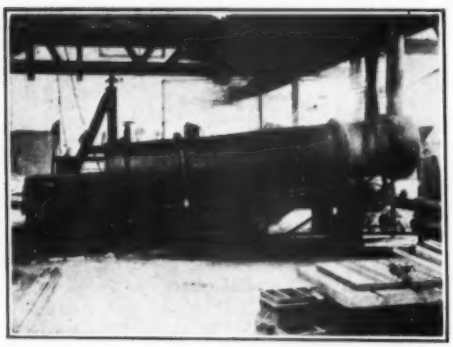


Fig. 1.—Rotary Dryer for Core Sand.

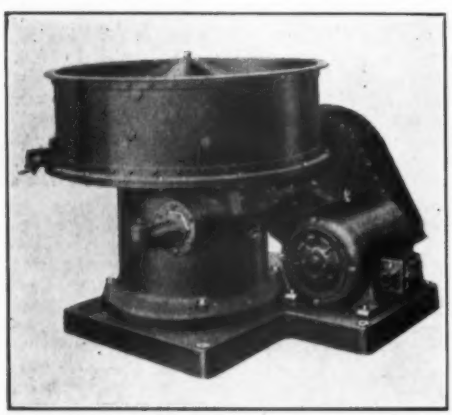


Fig. 3.—Core-Sand Mixer which Mixes 4 cwts. of Core Sand in 3 mins.

* A Paper read before the Birmingham Section of the Institute of British Foundrymen on March 21.

Raw Materials Used.

The sand used is a clean silica sand purchased in varying grades according to the class of castings being made, and every consignment is inspected by the laboratory and rejected if not conforming to the specification shown in Table I. This specification was drawn up, as it was found that many sands are not economically suited for oil-sand work. For example, the presence of clay or other colloidal bond definitely results in weaker cores after baking or else the use of more binder than is necessary. This same statement applies to sands possessing unsuitable grain size, as the finer the sand the more binder required to give a certain strengthened core. The finer the sand used, however, results in a better casting finish, but it should be specially noted that the finish is determined by the size of *predominating* uniform grain and not by any admixed finer material. Cores made from the larger grained sands invariably require their surfaces blackwashed, not from any lack of refractoriness, but simply to prevent the metal being forced into the spaces between the sand grains. An excerpt from a Paper by Grubb (Trans. A.F.A., Vol. XXXIII, 1926, page 814) reads as follows:—

"The benefits to be gained by proper selection and blending of core sands are very real. The writer has record of a case where moulding sand costing 3 dollars per ton was replaced with a clean silica sand costing 6.50 dollars per ton, in an oil bound sand. The change actually netted a reduction of 10 per cent. in the cost of the core-sand mixture, due to saving in binder, and reduced the labour of knocking out the cores more than 50 per cent. In another case, a blended sand mixture containing moulding sand was replaced by a straight bank sand, which carried the desired grain and clay content; the change in this case netted a saving of 70 cents per ton, or 12 dollars per average working day."

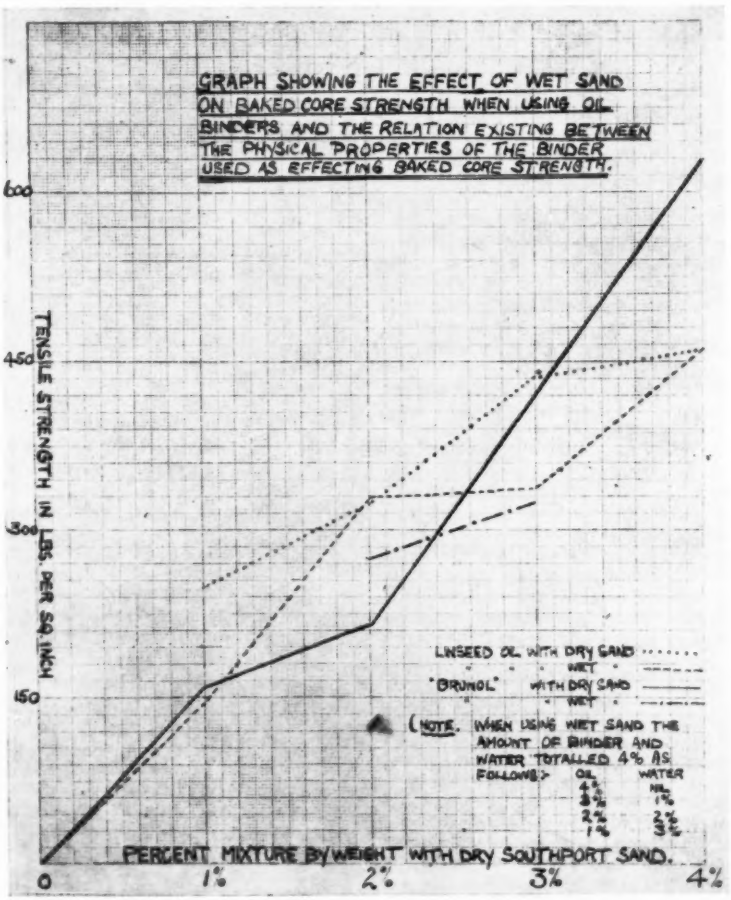

GRAPH SHOWING THE EFFECT OF WET SAND ON BAKED CORE STRENGTH WHEN USING OIL BINDERS AND THE RELATION EXISTING BETWEEN THE PHYSICAL PROPERTIES OF THE BINDER USED AS EFFECTING BAKED CORE STRENGTH.
TENSILE STRENGTH IN LBS. PER SQ. INCH
600
450
300
150
0
1%
2%
3%
4%
PERCENT MIXTURE BY WEIGHT WITH DRY SOUTHPORT SAND.
LINSEED OIL WITH DRY SAND
WET
"BRUNOL" WITH DRY SAND
WET
NOTE. WHEN USING WET SAND THE AMOUNT OF BINDER AND WATER TOTALLED 4% AS FOLLOWS:-
OIL WATER
4% NIL
3% 1%
2% 2%
1% 3%

Fig. 2.—Effect of Water on Strength of Cores made from Two Different Core Oils.

Special attention should be directed to the fact that many core sands evolve considerable quantities of gas when they are heated up to high temperatures. Table II gives some accurate determinations on local sands relative to this point. The amount of gas evolved from core sands depends on several factors, namely:—(1) *The casting temperature of the metal used.* All gases expand on heating, and the degree of expansion is proportional to the temperature. For instance, a certain sand may only evolve 8 times its own volume when cast with aluminium and 20 times its volume when cast with steel, and (2) *The amount of substances present that*

decompose with heat. These mainly consist of shell or limestone particles, which evolve carbon dioxide and organic matter, such as coal, plant roots, sea-weed, etc., which evolve carbon dioxide, oxygen and carbon monoxide. If there is any clay present steam is also formed, due to the removal of combined water. At the same time, it is extremely probable that sand contains nitrogen. From Table II it will be noticed that the analysis of gas evolved from N.E. Coast sea sand shows a high percentage of carbon dioxide, probably due to the decomposition of shell or limestone fragments. The amount of gas evolved from core sands is a very important matter, as some sands evolve more gas than that from the binder used.

The core sand is now dried in a rotary dryer as shown in Fig. 1. Sand containing moisture weighs less per cub. ft. than dry sand, as each grain of sand coated with a thin film of water has a slightly greater volume than that of the dry gains. This decrease in weight is especially noticeable in the case of fine sand, as it has a greater capacity for receiving films of water on account of the greater surface area of the grains relative to their mass. As the size of the grains increases, the difference in weight is less and less marked. Furthermore, not only does the use of wet sand preclude the use of accurate core-sand mixtures, but it also has a certain effect on the efficiency of the binder used. Fig. 2 shows the effect of water on the strength of cores made from two different core oils. It will be clearly noticed that when linseed oil is used with dry sand the core strengths obtained after baking are superior than when wet sand is used. This is to be expected, as the presence of water tends to emulsify the oil during mixing, and emulsified linseed oil is invariably thicker in consistency than the straight product. In this respect it is interesting to note that boiled oils emulsify easier, and the resulting emulsions are much more viscous than when raw linseed is used. In comparison with linseed oil, Fig. 2 shows the effect of water on a proprietary product. In this case the addition of water thins the oil and gives rise to increased core strengths when the binder is present below 2½ per cent. by weight and decreases the core strength when the binder is in proportions above 2½ per cent. by weight. From these facts a theory regarding the efficiency of the binder used relative to core strength can be formulated. Reverting to Fig. 2, it is evident that linseed-bonded cores reach a maximum strength when approximately 2 per cent. of oil is added. Any increase of oil over this percentage does not result in the additional strength value being obtained, due to the fact that the sand grains will only hold a certain definite thickness oil film. Any attempt to increase the thickness of the oil film results in waste of binder, as the oil simply has not the viscosity to adhere and runs out on to the core plates or bench. It is thus apparent that the thickness and viscosity of the binder used plays quite an important part in the core strengths obtained. If this theory is feasible the more viscous binders will produce stronger cores providing the binder is present in sufficient quantity, as the film on the sand grains will be of greater thickness, and therefore stronger, assuming, of course, that the oils are composed of like constituents. At the same time, it is obvious that the less viscous oils will mix easier and more effectively with the sand and will tend to be more economical when maximum core strengths are only of secondary importance.

Before leaving the question of wet sand, however, it must be understood that a reversal of these results can be easily obtained if the amount of moisture present is not known, due to the probability of more or less binder being unknowingly present, resulting from the fact that

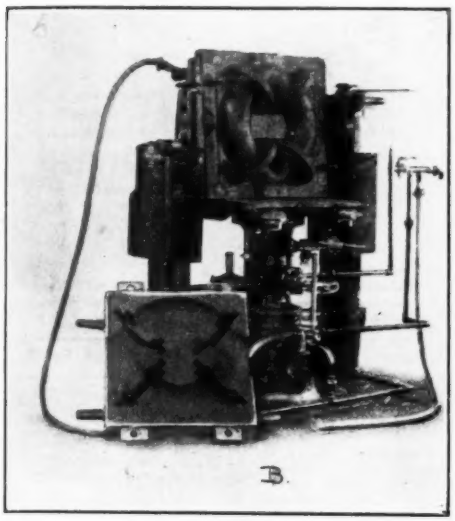


Fig. 4A.—Peacolt Jar-Ram Moulding Machine.

Whilst this shows a mould section in position the machine can be easily adapted for making cores. It is interesting to note the method used for obtaining two castings per box.

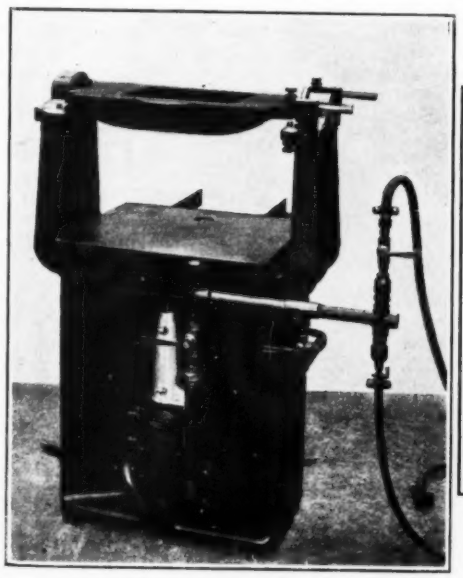


Fig. 4B.—The Coventry Turn-over Jar-Ram Machine.

The construction ensures long life and minimum repairs. The pattern-drawing piston is operated by oil through pneumatic pressure, giving a perfect draw. Steady pattern-drawing is not always obtainable with compressed air alone.

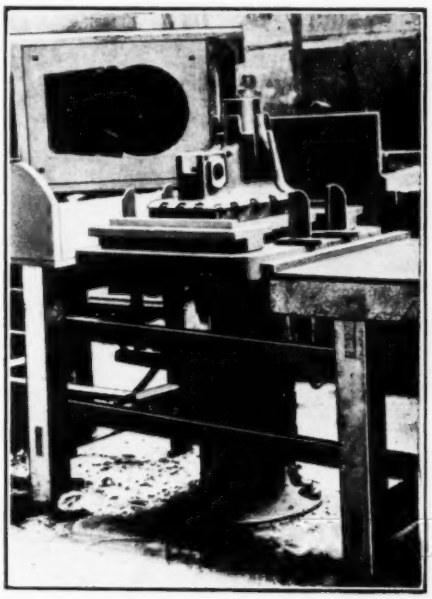


Fig. 4C.—Britannia Machine adapted for Bench Work.

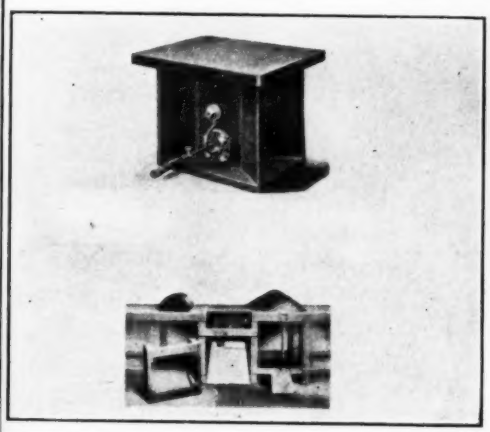


Fig. 4D.—The Mumford-Type Jolter for Core-making.

It is said for this machine that core boxes do not require clamping to the machine table, as they remain close to the table, and are not tossed. The machine is operated by a conveniently-placed knee valve.

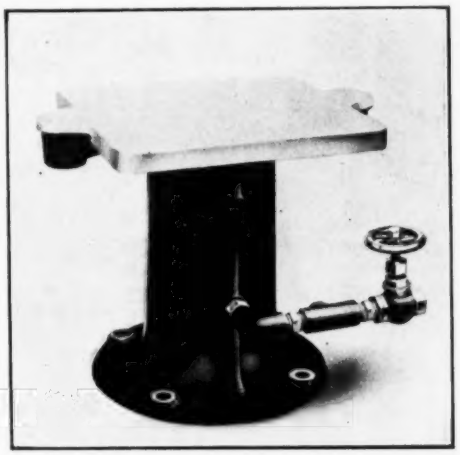


Fig. 4E.—Britannia Jar-Ram Machine for Core-making.

Fig. 5.—Osborn-Type Jolt Press Roll-over Machine.

With this machine the moulds are pressed after jolting. Striking off the sand prior to pressing is done by the simple striking-bar shown. This ensures a definite amount of sand being used.

the weight of wet sand is not the true sand weight. Furthermore, some binders have their viscosity lowered when heated, and this can also result in lowered core strengths after baking. It is obvious that if one compares two oil binders, both of the same consistency when cold, but one goes thinner on heating whilst the other thickens upon heating, then the best oil to use is the latter. The nature of the binder used is of very great importance, as it determines core strength, efficiency in mixing, stoving practice, degree and nature of gas evolved on casting and the extent of reclamation possible. This latter point should not be forgotten, as in the future it will no doubt be possible to reclaim not only the core sand, but a large amount of binder, and it will then be feasible to re-use core sand over and over again with only the addition of a small quantity of binder and new sand from time to time. In fact, one of the large American motor companies have recently put in plant for this purpose to reclaim cores coming from their aluminium crankcases. This firm uses a core mixture, made from bank sand, which contains a proportion of clay, oil, and cereal binder, and they have effected a saving, something like 105 dollars per day, or about £21. In this connection, however, it is obvious that the drying oils are out of the question as binders and the use of special binders becomes essential.

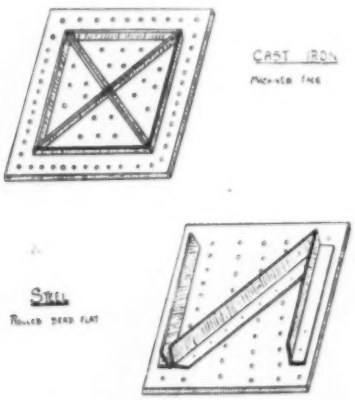


Fig. 6.—Reinforced Core Plates to Prevent Warpage.

Table I.—*Specifications for Core Sands.*

For Special Jacket Cores.—Bulk of sand grains should be between 30 and 60 mesh, and not more than 3 to 4 per cent. should pass 60 mesh. The sand should preferably be washed, and it must evolve no gas, or show signs of fritting on heating to temperature of casting. The ideal sand should consist of all its grains 40 mesh size. All cores made from the above sand should preferably be black-washed if good finish is desired.

For General Purpose Work.—Bulk of sand grains should be between 40 and 80 mesh, and not more than 20 per cent. should pass 80-mesh sieve. The sand must evolve no gas or show signs of fritting on heating to temperature of casting. The ideal sand should consist of all its grains 60 mesh size.

For Light Hardware Castings.—Bulk of sand grains should be between 60 and 90 mesh, and not more than 40 per cent. should pass 90-mesh sieve. The sand must evolve no gas on heating to temperature of casting. The ideal sand should consist of all its grains 80 to 90 mesh size.

Table II.—*Gas evolved from Core Sands and their Relative Refractoriness upon Heating to 1,200 deg. C.*

Sand.	Gas evolved from 1 cub. ft. of dry sand.	Appearance of sand after testing.
Leighton Buzzard	Nil	No fritting, but colour changes from yellow to pink.
Ryarsh silica . .	1.82 cub. ft.	Frits slightly. No change in colour.
Irvine sea sand (used in Glasgow district)	3.90 cub. ft.	Frits slightly. No change in colour.
Southport sea sand	16.40 cub. ft.	Frits slightly. No change in colour.
N.E. Coast sea sand (used on Tyneside)	36.25 cub. ft.*	Frits slightly and colour changes to greyish.
Mansfield red . .	Nil	No fritting.
Bromsgrove red . .	2.00 cub. ft.	Frits very slightly.
Reclaimed untreated used core sand (Leighton Buzzard)	32.80 cub. ft.	No fritting.

* Analysis of gas evolved: Carbon dioxide, 48.5, oxygen 8.5, carbon monoxide 1.5 per cent., and hydrogen nil. The balance is probably nitrogen.

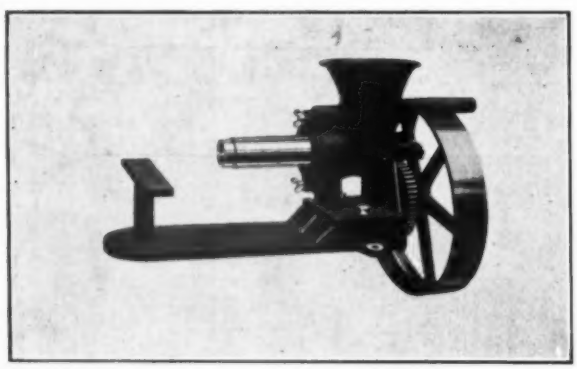


Fig. 7a.—Rotary Core Machine, hand driven, for making Round Cores up to 3 in. dia.

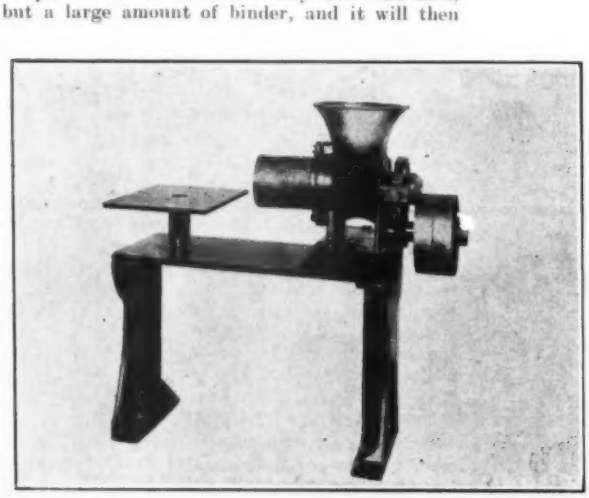
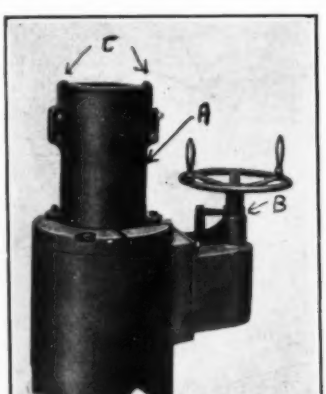


Fig. 7b.—Rotary Core Machine, power driven, for making Cores from 3 in. to 6 in. in dia.



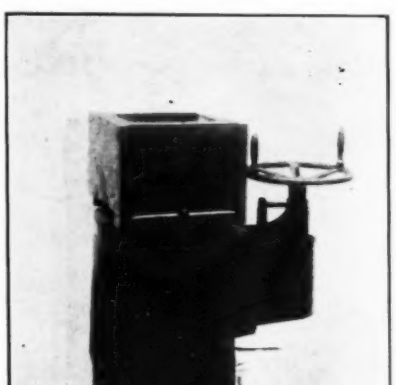


Fig. 8.—Machine for making Barrel Cores.

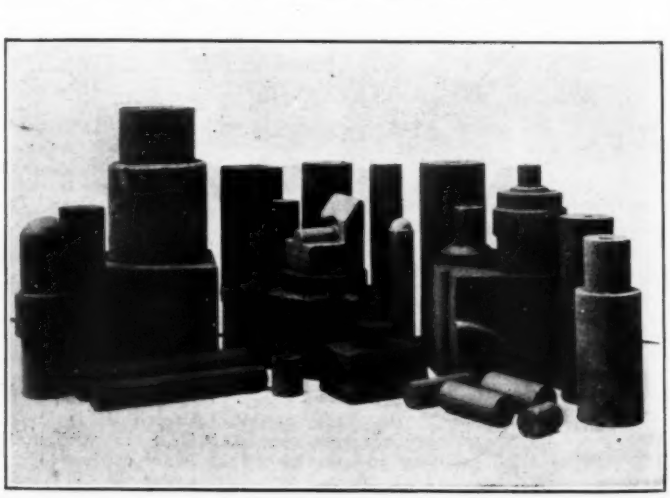


Fig. 9.—Group of Cores made on the Type of Machine shown in Fig. 8.

The binder used in the future foundry is of this last-named type. It belongs to the semi-solid class and imparts the necessary green-bond strength for intricate work by admixture with silica sand alone. For simple cores and where no green-bond strength is desired, the amount of binder is decreased and water added. Fully 50 per cent. of reclaimed core sand is incorporated in the mixture for most types of cores.

Mixing Methods.

All mixing is performed in a machine of the type shown in Fig. 3. This machine mixes a 4-cwt. batch of core sand in 3 min. Whilst the machine does not present sufficient pressure to crush the sand, yet a pressure of 40 lbs. per sq. in. is exerted when using semi-solid core binders. This ensures perfect mixing. The pressure there can be easily demonstrated if the sand-discharge slide be not closed properly, when the sand is squirted out. Furthermore, the pressure applied to the sand automatically varies according to the kind of sand being mixed. For example, the pressure applied on sand bonded with linseed

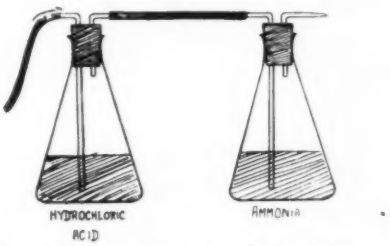


FIG. 10.—APPARATUS FOR INDICATING ACTUAL CIRCULATION OF AIR INSIDE A CORE STOVE.

oil is less than when mixing core compounds possessing green bond or when mixing ordinary moulding sands. The extra power automatically applied ensures perfect mixing, regardless of type of binder used, without a time increase. In mixing core sands it is important to have the proportions of binder and sand mixed by weight. All core binders do not have the same weight ratio to volume, and if the mixture is made up on a volume basis, any trials of new compounds are not accurate, nor are mixtures comparative with results obtained by individual workers. The same remark applies to sand as the weight of a cubic foot varies according to the nature of the minerals it contains, the size and shape of the particles and the pressure to which the mass has been subjected. For example, Searle gives the weight of 1 cub. ft. of river sand as 118 lbs., and the weight of the same volume of pit sand as 102 lbs., a difference of 16 lbs. per cub. ft. Whilst working mixtures on a volume basis may be more convenient it is the best practice to ensure that the volume of each material component used has been standardised by an original weight mixing.

Core-making Equipment.

All the larger-sized cores made from the sand without green bond are "bumped up" on a turnover, pattern-drawing jarring machine fitted with a vibrator on the core plate (Fig. 4). For the bonded sand a jolt-squeezing machine is used with the same auxiliary fittings (Fig. 5). The advantages that machine moulding has over handwork are:—(1) Increased production, (2) greater uniformity of castings, (3) superior finish and (4) reduced costs. Machine-moulded castings can be made from one-sixth to a quarter of the cost at which they can be made by hand, and on a machine the core box is drawn perfectly true. The results accomplished, however, are essentially determined by the type of machine selected and the method of making and moulding the patterns and core boxes. Another recent machine, which has found favour abroad, is the core-blowing machine. Most small core work can be made to advantage on this machine, including cores for plumbing goods, pipe fittings, stove burners, valves, vacuum cleaners and various automobile castings. The core is made by forcing the sand into the core box by compressed air, the operation of filling the box being accomplished in about 5 secs., regardless of the size and shape of the box. Simple, sharp, sand cores can be made with 70-lb. air pressure, whereas intricate cores and standing cores made from sand possessing slight bond require pressures of from 100 lbs. to 125 lbs. The machine is controlled by light pressure upon a treadle, the air automatically performing the several operations successively, clamping and filling the core box and releasing it after the core is made. It has a capacity of about 200 cores per hour, though much greater production is often obtained on cores which are easily removed from the core box. The machine is unquestionably most successful on silica sands bonded with thin

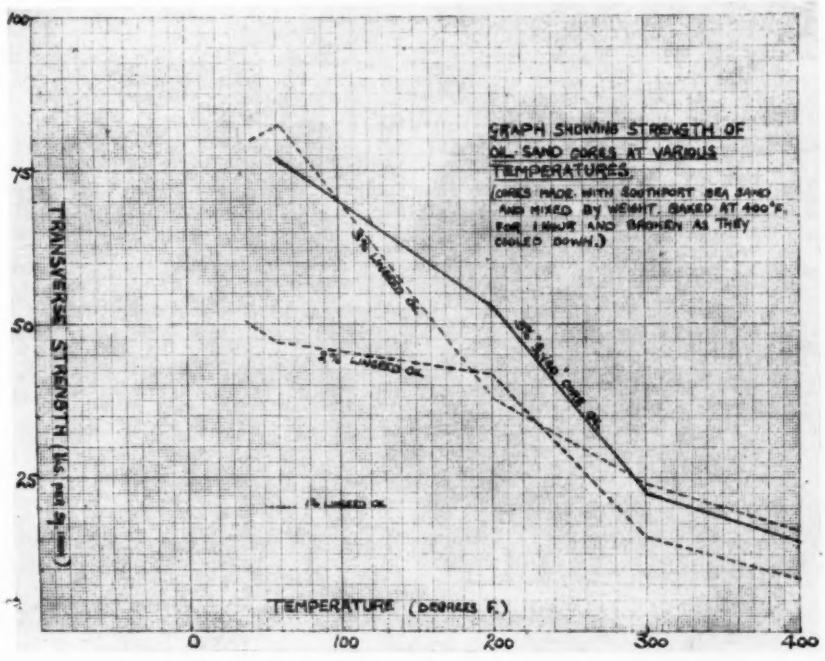


FIG. 11.—STRENGTH OF OIL-SAND CORES AT VARIOUS TEMPERATURES.

binders. All the core plates used are reinforced to prevent warpage in the core stove and machined dead-flat on top (Fig. 6). Medium-sized cores are made by hand. For the production of uniform cylindrical and rectangular sectional cores, rotary-core machines are used. These machines can make lengths of cores from $\frac{3}{8}$ in. to 6 in. diameter. Figs. 7A and 7B show two sizes of machines used. Providing the correct sand mixture is employed, these machines are capable of producing at least 4 ft. of ½-in. dia. cores per min., or 3 ft. of 3-in. dia. cores per min. The entire success of these machines, however, essentially depends on the core-sand mixture used, as they will not satisfactorily work on any kind of sand. The best sand to use is a tough-bonded non-sticky sand, having a green-bond strength of at least 3 in. The sand should not be too coarse in texture and should correspond to the figures given in Table I for that used for general purposes. Lane gives a very good suggestion, helpful in preventing the cores buckling when using this type of machine. The suggestion is to have the machine mounted on a hinged board so that the machine can be tipped downward at various inclinations, which helps the movement of the core along the plate and keeps the core correct to the die dimension.

Another machine used for making barrel cores to definite diameter and length is shown in Fig. 8. For the want of a better term, those are called "ejection-stripping machines." The machine shown is suitable for making round, half-round, chamber, square and similar-shaped cores. The machine consists of a screwed ram operated by a handwheel. The core box A is held in place by two levers C, and the top of the ram forms the base of the core box. The ratchet B controls the handwheel. To make a chamber core there is no need to make a special box, as split bushes are rammed up in the circular core box. For cores of irregular shape, the circular box is removed and the special box fitted. Specially-shaped pieces can be fastened to the box or frame or left loose, according to their position and design. The box is then rammed up and the core ejected without any rapping or separating of the box. Fig. 9 illustrates a group of cores made on this type of machine. Other points relative to the construction of the cores worthy of mention are the precautions taken to prevent any "washing" at points where there is a likelihood of runner impingement. Where metal must flow through or over a core, it is difficult to prevent cutting or washing by using bonds of a carbonaceous nature only. In this respect, the binder used in this present instance, whilst certainly more resistant than straight oil, is protected from

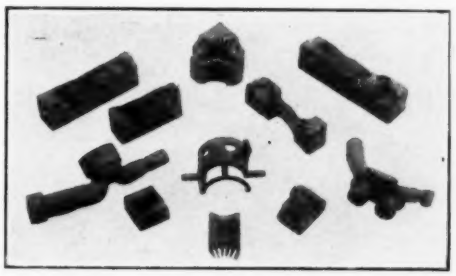


FIG. 12.—GROUP OF AIR-COOLED CYLINDER CORES.

burning out too early by the use of a special refractory wash made from sodium silicate and applied after the core is baked. In cases where direct heavy impingement occurs, a special sand mixture is rammed up in the core opposite. This mixture containing clay-bond and excess binder. A suitable mixture would consist of 2 parts sea sand, ½ to 1 part fireclay. Very often this trouble can occur by too economical use of binder, as if the binder is present in the

core in sufficient quantity, the metal is not liable seriously to eat into or burn the core. Of course, the ideal is to keep the direct metal flow from the runner from striking the core, but this is not always possible in many types of

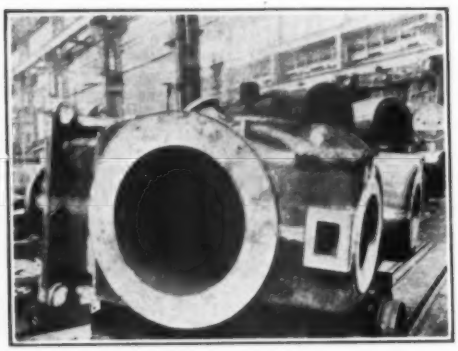


Fig. 13.—28-in. Corliss Cylinder Casting, Cored throughout with Oil Sand.

castings. In regard to the use of black-wash, this is only employed in special instances, when the core is made from very open sand or when fluid metals, such as brass, are cast, or when extremely hot metal is used in conjunction with

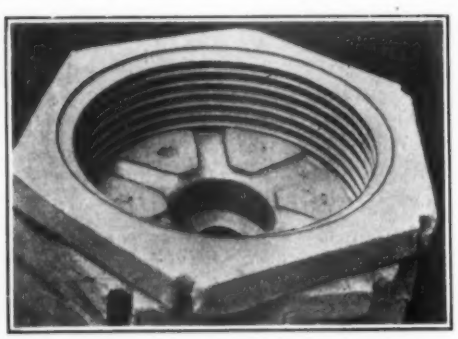


Fig. 14a.—Mould made as Core for Rope Pulley.

severe mould pressures. The black-wash used consists of plumbago, refractory clay and water, containing a small quantity of core binder.

Baking Practice.

Efficient and successful oil-sand practice essentially depends upon the use of good drying stoves. A temperature of 205 deg. C. is amply

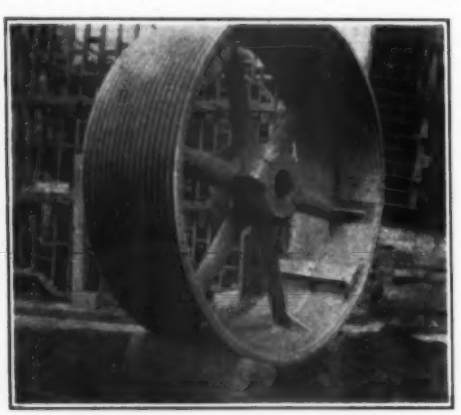


Fig. 14b.—Casting from Mould.

sufficient to cover the drying of most oil-sand mixtures, and the quickest drying time, with greatest stove efficiency, is obtained by a good inside stove circulation. The core stoves are fitted with recording thermographs. The degree of air circulation, however, should not be too great, as trouble will arise due to the outside of the cores being burned or finished baked, whilst the inside is still green. It is a good idea to include test-cores in the stove, and after baking an examination of their fracture will show the efficiency of the baking process. A handy little apparatus that has proved most useful in showing the actual circulation of air inside a core stove, and which, by the way, has proved very useful in testing the effectiveness of core vents, is illustrated in Fig. 10. This consists of two bottles connected up as shown, one containing ammonia and the other hydrochloric acid. By blowing on the rubber tube dense clouds of a white gas are formed, which is carried along in the air current and clearly shows the path taken by the air. This is very useful in correcting any drying troubles occurring through unequal air circulation inside the stove. Fig. 11 brings to light an important point overlooked in many foundries. This graph shows the strength of oil-sand cores at different temperatures, and it should be noticed that the strength of a core made from 3 per cent. weight mixture of linseed oil at 205 deg. C. (400 deg. Fah.) is not equal to that of a 1 per cent. oil mixture at room temperature. No cores are issued to the moulders in the future foundry until they reach their maximum strength around 60 deg. Fah. (15 deg. C.). One large foundry in America, using a great many oil-sand cores, changes its oil-sand mixture, at about 3 p.m., by decreasing the amount of binder 15 per cent. The reason for this is that the cores will subsequently be run out of the oven on to plates and left to cool overnight before they are handled, so that the full strength of the binder will be developed. During the day they are ordinarily taken from the plates hot and carried to the moulders. Even such a practice as this is not to be recommended, in view of the results shown in Fig. 11.

Storage of Cores.

All cores, even those made from linseed, are affected by dampness, and it is not good practice to allow *any* class of cores to lie overnight in green-sand moulds. At the same time, it is an economical investment to provide for warm dry storage as an integral part of core-shop building.

Figs. 12 to 14 show the possibilities in oil-sand work and the successful application of them to practice. It can be safely said that any casting, no matter the size or shape, can be made from this type of sand.

Jobbing Moulding.

(*Continued from page* 361.)

Bedding in the Floor Obsolete.

Mr. R. D. Welford (Bradford), seconding the vote, said Mr. Worcester had brought a series of practical reminders and a general plea for more careful thought in the foundry. The best craftsman, undoubtedly, was the man who visualised the finish of the job before he started on it. Especially did this apply in loam work, where a man had to make his tackle to suit the particular job. He (Mr. Welford) had always felt that more "wasters" were made in the foundry through oversights than by ignorance, and in the small things he was afraid it was true to say that the average moulder did not devote sufficient of his personal attention to detail. Mr. Welford said he did not agree with quite everything that Mr. Worcester had said. He thought, for instance, that the matter of ramming the mould in pits was rather a bygone method, unless, of course, it was a very deep job.

Mr. Worcester, replying to the vote of thanks, and making particular reference to Mr. Welford's final observation, said he was certainly no advocate of ramming loam jobs generally. The plate was a useful thing to have in a foundry, but he would always much rather buck-stay the average job.

Sixth International Congress of Mining, Metallurgy and Applied Geology.

LIÉGE, JUNE 22-28, 1930.

In connection with the Sixth International Congress of Mining, Metallurgy and Applied Geology, to be held at Liége on June 22 to 28, 1930, the Committee formed for the purpose have issued the following list of subjects proposed for discussion at the meetings:—

Section B.—Metallurgy.

Blast Furnace.

Practice with Blast Furnaces with Rapid Driving.—(*a*) Raw materials; (*b*) burdens; (*c*) yields; (*d*) equipment.

Valuation of By-Products.—(*a*) Utilisation and elimination of dust; (*b*) utilisation of slag.

Manufacture of Steel and Ferro-Alloys.

Corrosion.—The problem of corrosion of iron and iron alloys; influence of elements dissolved in these alloys for checking corrosion; protection of surfaces by means of metallic coatings; steels resistant to oxidation at high and low temperatures; general study of the properties of steels subjected to varying stresses at high temperatures, with special reference to the resistance of steels to corrosion.

Casting of Ingots.—Progress in the casting of steel ingots from the point of view of diminishing the pipe, blowholes, and segregation; influence of deoxidisers on the physical condition of ingots; continuous casting and centrifugal casting of steel.

Rails.—Mechanical properties of rails manufactured by different metallurgical processes; chemistry of rail steel; the estimation of oxygen and nitrogen in steels, influence of these elements on the properties of rails; heat treatment of rails; defects in rails revealed when put into service; their remedies.

Sheets.—New developments in the rolling of sheets; continuous rolling of sheets, adoption of the method in Europe; cold-rolling of sheets, the economic limits of the use of cold-rolling; the manufacture of sheets for the automobile industry.

Foundry.

Methods of Testing Cast Iron, High-Duty Cast Iron—Tempering Castings, Foundry Sands, Malleable Castings.

Non-Ferrous Metals.

Influence of the Concentration of Ores by Flotation on their Metallurgical Treatment.—(*a*) Influence on the roasting; (*b*) influence on the reduction.

Electrolytic Production of Metals.—(*a*) The dissolving of metals; (*b*) purification; (*c*) influence on the purity of the metals.

Repercussion on the Belgian Metallurgical Industry of Mining and Metallurgical Developments in the Belgian Congo.—(*a*) Copper and cobalt; (*b*) tin; (*c*) precious metals: radium, gold.

Non-Ferrous Alloys.

Light Alloys.—(*a*) Industrial standardisation of light aluminium alloys; (*b*) magnesium alloys; (*c*) beryllium alloys, with special reference to materials of high modulus of elasticity.

Alloys containing Cobalt.—(*a*) In presence of copper; (*b*) in presence of aluminium; (*c*) in presence of other metals.

Non-Ferrous Alloys for Cutting Tools.

Metallic Coatings.—(*a*) Their formation; (*b*) their properties.

Fuel.

Reactivity of Fuels.

Utilisation of Gaseous Fuel.—(*a*) Long distance transport; (*b*) connection between different departments of a works.

Thermal Control.

Communications should be addressed to the General Secretary, Committee of Organisation, 16, Quai des Etats-Unis, Liége, Belgium.

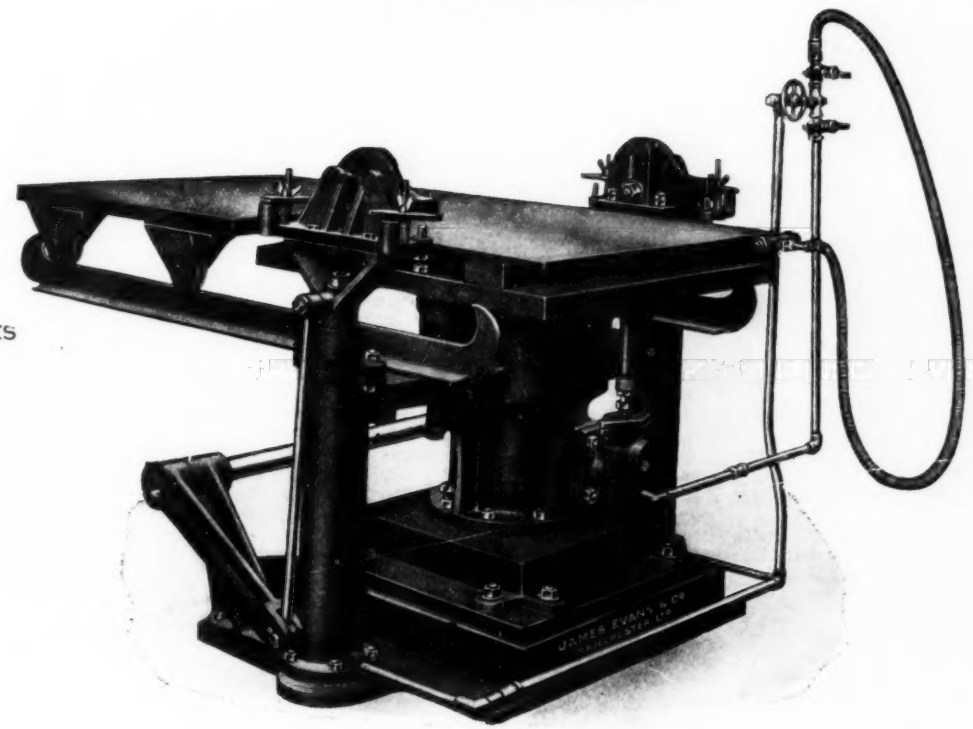
TYPE "C"

JAR RAM MOULDING MACHINE

with Turnover Pattern Plate.

For Pneumatic Power.

TWO MACHINES IN ONE.



UNSKILLED LABOUR ONLY REQUIRED.

The above machine illustrates a Jar Ram Machine with Turnover Pattern Plate which can also be used for Stripping Plate Work.

The machine has been designed to combine the two distinct features above mentioned, and is practically two machines in one, equally suitable for steel, iron, etc.

The machine as illustrated is arranged for work that requires turning over, such as steel moulding. And while the turnover arrangements are intended for general repetition work, by detaching the turnover plate from the trunnion brackets the machine can be used for stripping plate work by attaching the stripping plate to the trunnion brackets. Or, on the other hand, by removing the trunnion brackets as well, the table can be used for jolting general jobbing work.

A very important feature of the machine is the simplicity with which the intensity of the Jolt can be regulated when the operator has become accustomed to the use of the machine, which takes but an hour or so. The valves all being on the exterior of the machine are easily accessible, and there is an adjustable arrangement that will allow the jolt to be varied between 1½ in. to below ½ in. This being done without disturbing any part of the machine.

The machine is supplied with Withdrawal Carriage, Vibrator, and Blow-off Nozzle complete. It is substantially constructed to stand heavy wear and tear, and requires a minimum amount of skill to operate.

Another important feature of the machine is in the arrangement of the hard wood anvil block for receiving the shock. The blocks being carried well down the machine in a specially designed annular chamber give considerable relief to the foundations. It also provides against the possibility of fracturing the jolting table. Pitch pine blocks are also inserted between the foundation plate and the machine bedplate to assist in the relief on the foundations, and these features considerably improve the working advantages of the machine.

IT IS ALSO ENTIRELY OF BRITISH DESIGN AND MANUFACTURE.

JAMES EVANS & CO. (M/c) LTD.

Britannia Works, BLACKFRIARS, MANCHESTER.

Trade Talk.

A NEW STEEL-MELTING FURNACE, of Italian design, is to be erected at the works of the Consett Iron Company, Limited. The annual output is estimated at about 47,000 tons.

THE CIRCULAR SAW AND FILE DEPARTMENTS of Messrs. Edgar Allen & Company, Limited, Sheffield, are being entirely reconstructed, and new plant and machinery is being put down.

A CONTRACT HAS BEEN PLACED with Messrs. William Denny & Bros., Limited, Dumbarton, for the construction of a passenger vessel for the London Midland & Scottish Railway Company.

MESSRS. GEORGE COHEN, SONS & COMPANY, LIMITED, machinery merchants, have decided to retain the works of Messrs. John Butler & Company, Limited, Stanningley, Leeds, as a northern stock depôt.

THE DUNDEE HARBOUR TRUSTEES have agreed, subject to approval of the Unemployment Grants Committee, to accept the tender of Messrs. Fleming & Ferguson, Limited, Paisley, for the construction of a single-screw steam hopper barge.

MESSRS. WILLIAM DENNY BROS., LIMITED, Dumbarton, have received an order from the London Midland & Scottish Railway Company for a vessel for service on the Larne to Stranraer route. The vessel will be twin-screw geared-turbine driven and have a trial speed of over 20 knots.

THE CORMIX COMPANY, of Great Arthur Street, Smethwick, have patented (No. 9579) and placed upon the market an aluminium melting flux. There is a special method employed for using this flux that is covered by a second patent (No. 11620). The major claim is that by its use pinholing is completely eliminated.

MESSRS. JOSEPH ADAMSON & COMPANY, engineers and boilermakers, Hyde, Cheshire, have purchased the goodwill of Messrs. Tinker, Shenton & Company, Limited, Hyde Boiler Works, including their patterns, drawings and other records of past work. Messrs. Tinker, Shenton & Company, Limited, are in voluntary liquidation.

MESSRS. H. J. C. CARRINGTON & COMPANY have established themselves at 108, Ryland Street, Birmingham, for the manufacture of general engineering specialities. Amongst the specialities to be manufactured at the outset is the special rumbling plant, a description of which appeared in our columns in September, 1928.

THE GREAT WESTERN RAILWAY COMPANY have placed orders for 25 engines with each of the following firms:—Sir W. G. Armstrong, Whitworth & Company (Engineers), Limited; W. G. Bagnall, Limited; Beyer, Peacock & Company, Limited; and the North British Locomotive Company, Limited. The value of the order exceeds £250,000.

THE MONTHLY LUNCHEON arranged by the Committee of the London Iron and Steel Exchange took place at 1 p.m. on May 13, at the Great Eastern Hotel. An address was given by Mr. E. F. Wise, M.P., Economic Adviser to the Russian Co-operative Movement, on "Openings for the Steel Trade in Russia." The luncheon was followed by a meeting of the Exchange.

THE SUFFOLK IRON FOUNDRY (1920), LIMITED, Gipping Works, Stowmarket, who manufacture a range of lawn-mowers, wringing machines, lawn-markers, tennis posts and other sports goods, last Thursday received a visit from the Norwich and Norfolk Ironmongers' Assistants' Association. Such visits are designed to give the salesman a better appreciation of the goods he handles.

MESSRS. NON-FERROUS DIE CASTINGS COMPANY, LIMITED, of Nonferdica Works, North Circular Road, Cricklewood, London, N.W.2, desire us to announce that it is in no way connected with the Non-Ferreous Castings Company, of 56, Broad Street, Birmingham. The latter company has called a meeting of its creditors, and the similarity of names may create confusion. Trade Papers please copy.

THE NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, Springburn, have received an order for 25 side tank engines of the 0-6-0 class from the Great Western Railway group. The order is similar to that for 50 engines completed early last year for the Great Western Railway, and is particularly welcome in the district where short-time working has been the general rule for some time past. The same firm have also received an order for ten locomotive boilers for the Sudan Government railways. With orders in hand for the Rhodesian Railway, Shanghai-Nankin Railway and Tharsis Sulphur & Copper Company, Limited, Spain, the outlook has improved considerably in the Scottish locomotive industry.

IT IS STATED that arrangements have been made to place the plant of the Pressed Steel Company of Great Britain, Limited, at the services of all sections of the motor industry, and this is expected to lead to a considerable development of the production of steel motor bodies and pressings for motor-cars at the company's Cowley works. Hitherto the voting control of the company has been in American hands, and the head of one of the biggest British motor manufacturing concerns has held a large interest. The voting control has been transferred to British hands, and the British manufacturer referred to has sold his holding, so that the company is now independent. The plant at the Cowley works has not yet worked to capacity, but it is anticipated that under the new arrangement there will be a substantial increase of output.

Personal.

MR. T. W. HAND, chief engineer to Messrs. Davy Brothers, Limited, Sheffield, has been appointed chief mechanical engineer to Messrs. David Colville & Sons, Limited, Glasgow.

MR. THOMAS MENSFORTH, who has recently been engaged as works manager of the Darlington Rolling Mills Company, Limited, has been appointed electrical engineer to Messrs. Dorman, Long & Company, Limited.

MR. SUMMERS HUNTER, managing director of the North Eastern Marine Engineering Company, Limited, has retired after nearly 50 years' active service with the firm. Mr. Hunter was the recipient recently of presentations from the workmen of the Sunderland and Wallsend works and from the directors, officials, foremen and staff.

MR. THOMAS M. TAYLOR, honorary treasurer and past-President of the West of Scotland Association of Foreman Engineers and Draughtsmen, was entertained to dinner in the Grosvenor Restaurant, Glasgow, by the past and present office-bearers of the Association. Mr. Thomas Lawson presided, and Mr. James M. Miller, a past-President, in the course of the evening, presented to Mr. Taylor, on behalf of the subscribers, a wallet of Treasury notes as a mark of appreciation of the valuable services which he had rendered the Association. Mr. Taylor said that during the 25 years which he had belonged to the Association the financial turnover had increased from £180 to £2,100 and the membership from 112 to 630.

Wills.

HALL, JOHN, chairman of Messrs. Hall & Pickles, Limited, Manchester £82,416

WHYMAN, THOMAS, managing director of Whyman's Foundry Company, Limited, Warrington £24,395

MACKLEY, E. N., of Messrs. E. N. Mackley & Company, pump manufacturers and ironfounders, of Hawks Road, Gateshead-on-Tyne £22,615

STRACHAN, G., J.P., a director of the Fairfield Shipbuilding & Engineering Company, Limited, Govan, and other companies £80,623

Reports and Dividends.

Allen-Liversidge, Limited.—Interim dividend on the preference shares at the rate of 6½ per cent. per annum

General Refractories, Limited.—The report covering 15 months to December 31 last shows trading profit, £12,840; brought in, £4,317; interest charges, etc., £2,816; dividend of 12½ per cent.; reserve against depreciation, £2,500; carried forward, £4,614.

Associated Lead Manufacturers, Limited.—Net profit, £119,063; goodwill and processes, £8,000; stamp duty, £4,000; base stocks written down, £20,000; income tax, £12,000; brought in, £28,348; dividend on the ordinary shares of 2½ per cent.; carried forward, £26,097.

Zinc Corporation, Limited.—Participating dividend of 2s. per share on the preference and ordinary shares, making total distributions for 1929 of 7s. 6d. per share on the preference and 3s. 6d. per share on the ordinary shares. An interim dividend of 2s. per share on the preference shares for 1930 is also declared.

Contracts Open.

Buenos Aires, July 10.—Two steam cranes, for the Argentine State Railways. The Department of Overseas Trade. (Reference A.X. 9,518.)

Cairo, June 25.—Pumping machinery, etc., for the Egyptian Ministry of the Interior. The Department of Overseas Trade. (Reference A.X. 9,509.)

Dundee, June 12.—655 ft. of cast-iron spigot and faucet piping, for the Town Council. Mr. D. H. Bishop, general manager and engineer, Dudhope Crescent Road, Dundee. (Fee £2 2s., returnable.)

Eccles, May 17.—Wrought-iron railings and gates, for the Parks Committee. The Borough Surveyor, Town Hall, Eccles. (Fee £1 1s., returnable.)

Johannesburg, July 7.—Grab crane, for Durban Harbour, for the South African Railways and Harbours Administration. The Department of Overseas Trade. (Reference A.X. 9,506.)

London, S.W., May 21.—Overhead travelling cranes, for the Bombay, Baroda and Central India Railway Company, The White Mansion, 91, Petty France, Westminster, S.W.1. (Fee 10s., non-returnable.)

Santiago, June 24.—Iron wire, galvanised iron wire, barbed wire, copper wire, tinned iron wire gauze, iron chains, metals in ingots (antimony and aluminium) and foundry crucibles, for the Chilean State Railways Department. The Department of Overseas Trade (Room 60).

St. Teath, Cornwall, May 26.—3,500 yds. of cast-iron mains, etc., for the North Cornwall Joint Water Board. Messrs. Lemon & Blizard, consulting engineers, 24, Lockyer Street, Plymouth. (Fee £3 3s., returnable.)

Whitwell, I. of W., May 20.—155 yds. of galvanised steam pipe and 36 yds. of cast-iron main, for the Isle of Wight Rural District Council. The Offices, 30, Pyle Street, Newport, I.W.

New Companies.

Agricultural & General Engineers (South America), Limited, Aldwych House, London, W.C.—Capital £5,000. Directors: G. E. Rowland (chairman), G. D. Perks (vice-chairman), J. Caoul and W. H. Cullington.

Sir Robert McAlpine & Sons (Midlands), Limited.—Capital £250,000. Civil and general engineering contractors, etc. Directors: Sir Robert McAlpine, Mr. R. McAlpine, Mr. W. H. McAlpine, Sir Malcolm McAlpine and Mr. A. D. McAlpine.

Obituary.

MR. W. H. DIESELHORST, formerly general manager of Messrs. Siemens Bros. & Company, Limited, Woolwich, died recently. Mr. Dieselhorst retired in 1915 after an association with the company extending for over 40 years.

MR. DANE SINCLAIR, chairman of British Insulated Cables, Limited, and a director of various cable construction, telephone and electric supply companies, died on Tuesday, May 6, at his residence at Weybridge, aged 78. Mr. Sinclair had been associated with British Insulated Cables, Limited, for a long period, first as general manager, then as managing director, and latterly as chairman.

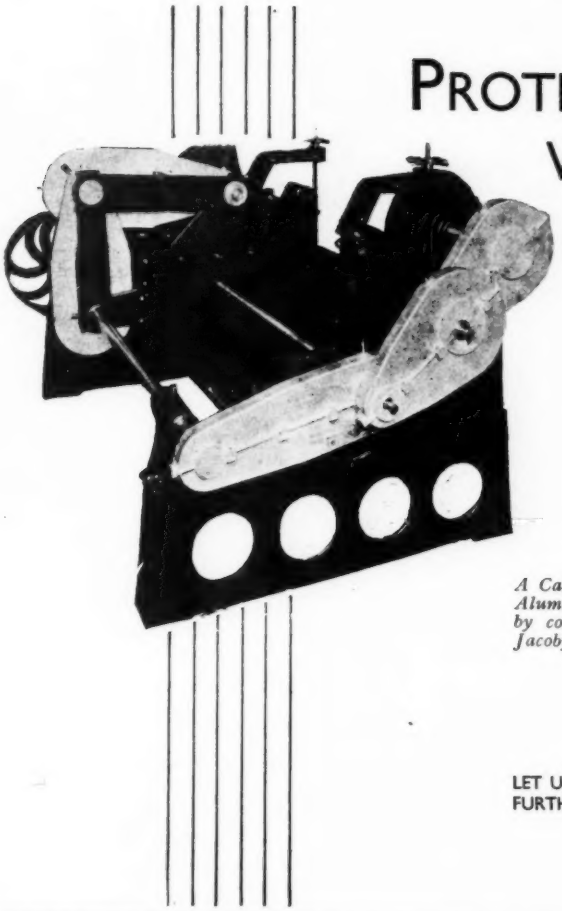
SIR BENJAMIN LONGBOTTOM, a Vice-President of the British Electrical and Allied Manufacturers' Association, died on May 1 in his 54th year. From 1922 to 1925 he was chairman of the British Electrical and Allied Manufacturers' Association, and he presided in 1924 over the British National Committee of the first World Power Conference. He was a managing director of Messrs. Laurence, Scott & Electromotors, Limited, and a director of Messrs. Richard Johnson, Clapham & Morris, Limited. He was knighted in 1925.

MR. WILLIAM MCMASTER, a prominent Canadian industrialist, died at Montreal on Monday, May 5, aged 79. Mr. McMaster was born in Montreal in 1851. After leaving school he entered the employ of Messrs. Morland, Watson & Company, the owners of an iron and steel foundry which, in the course of time, became the Montreal Rolling Mills, and of which he eventually became managing director. He took an active part in the promotion of the merger which produced the Steel Company of Canada, and remained a director of that corporation until his son, Mr. Ross McMaster, who is now its President, succeeded him.

XUM

F.T.J. 15.5.30.

PROTECTION WITHOUT SURPLUS WEIGHT



WHENEVER the efficient operation of moving parts is likely to be prejudiced by dust, flying breakages, accidental knocks or atmospheric changes, the provision of a protective casing becomes imperative.

Aluminium is particularly suitable as a protective casing. It is comparatively non-corrosive, it will not warp, and casings of even large dimensions are easily manhandled because of Aluminium's lightness.

A Callendar Roll Grinder with Aluminium chain cases. Photo by courtesy of Messrs. White, Jacoby & Co., Ltd.

LET US SEND YOU FURTHER DATA.

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ALUMINIUM PRODUCERS. ADELAIDE HOUSE.
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Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

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DUNSTON-on-TYNE

"TEAM" PATENT COKE

SPECIAL FOUNDRY QUALITY

FOR PRICE AND PARTICULARS APPLY TO:—

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25, COLLINGWOOD STREET,
NEWCASTLE-ON-TYNE.

TYPICAL ANALYSIS (if necessary guaranteed).

ASH	not exceeding	8%
SULPHUR	,, ,,	0·8%
VOLATILE	,, ,,	1 %
MOISTURE	under	1·50%

Company Meeting.

General Refractories, Limited.

RECORD SALES AND PROFIT—A REAL "DREADNOUGHT."

Taxation's Ill-effect on Re-equipment.

MR. FRANK RUSSELL'S REVIEW.

At the annual general meeting of General Refractories, Limited, held on Monday, May 12, in Sheffield, the Chairman (Mr. Frank Russell, F.G.S.), after dealing in detail with the accounts, and stating that the sales and profit for the period under review constituted a record, said: This year, so far, we have maintained our sales so well that we are ahead of last year, and we see no reason to suppose that the year's turnover will not constitute another record.

The demand for certain of our specialities is at this moment so great that an extension of manufacturing facilities is essential. We must not lag behind, and the present position is that the selling and manufacture of certain new lines in firebricks (including an absolute Dreadnought of a firebrick, to which I shall refer later), lines we have tested for ourselves and proved to be good, and likely to meet definite wants, have to be held back because our existing plant is fully occupied in meeting current requirements in our standard brands

We are glad to say we have been able to provide a considerable amount of extra employment during the year, and we feel sure that the expansion of our ordinary business and the new lines we have introduced, will keep us busy for a long time to come, and call for the employment of many more additional workers.

Need for Progress.

The firm that stands still is soon a firm that is going backwards, and we feel it is our duty to our shareholders, our customers, and ourselves, to use our brains to produce from time to time new refractories to meet fresh wants of industry, and particularly to provide refractories that will meet the daily more exacting requirements of the metallurgical trades.

We have at Worksop the completed plans of a works that will give us all we want, and, in addition, enable us to divert orders from other works with a saving of expense.

This plant is laid out in units, of which some have already been completed and are in daily use, and it is our need and our desire to build the rest at once.

We have had very satisfactory results from the re-equipment we have already effected, and we must prepare for the future by extending it to our other works, and particularly those at Ambergate.

This means money, but, I think we have shown that we can use money to advantage, and I want here and now to tell you that your directors are men who realise that every penny entrusted to them is somebody's savings and the result of somebody's self-denial somewhere, and that my co-directors and myself will guard your money more jealously than we shall guard our own.

Re-equipment of Industry.

In his presidential address to the Federation of British Industries Mr. Lennox B. Lee said: "In order to secure greater efficiency of production and to enable us to meet competition in foreign markets we must scrap most of our old plant and put in new.

"The key industries of the country," he said, "are in an admittedly depressed condition, the main reason for this being that our costs of production are too high and consequently our products cannot compete in price with those of contending countries."

The re-equipment of industry, by which I mean providing it with means whereby it can produce at a lower cost and thus face the world's competition, is a profitable business, and it is overdue.

A National Duty.

The days of our complacent national self-satisfaction are gone for ever, and I respectfully submit to you that it is a national duty on the part of investors to support those who are producers (as we are) of one of the very root essentials on which all manufacturing industry is based, and without which civilisation would be impossible, and who have shown themselves (as I suggest we have) well able to hold their own with old-fashioned equipment, who know exactly what they want to do, how they want it done, and are prepared to spend their lives in doing it.

There need be no fear about an adequate return on money spent on re-equipment—nothing yields such dividends as £1,000 spent on a machine that produces bricks at the rate of 1,000 per hour for eight hours a day, and saves £1 on every thousand; or a Ruston Digger, like the one we have recently purchased, and which has reduced certain costs from 10½d. to 3d.

This being the position, your directors have decided that additional capital can be very beneficially employed by the company. They assure the shareholders, however, that they will have the first right to subscribe to any new issue that may be made, and that any shares for which they do not subscribe will be placed in good hands.

Meaning of "Refractories."

From time to time I find there are those among my friends who are unacquainted with the meaning of the word "refractories." It is certainly a word of strange import, more reminiscent to the man in the street, of Borstal Institutions and industrial schools, than firebricks and goods in the form of pastes, powders, sands and cements, designed to "refract" or resist the action of heat

Every steel furnace is built of refractories, every glass furnace, every baker's oven and every lime kiln. There is no copper, zinc, or brass works that does not use them, and they are essential for the production of iron, coke, steam, sugar, pottery, gas, electricity and everything on which civilisation depends.

We make them as well as we know how, but, nevertheless, the conditions in which they are used are so severe that they burn out and require renewal at regular intervals.

There is thus a regular demand for supplies of refractories, just as there is for the morning milk and the baker's loaf, and the demand is increasing daily as greater and greater heats are employed in industry in order to get quicker results.

Advantages of the Insulite Brick.

This presents an even extending demand on a refractories service, such as ours, and this has recently been enlarged by the introduction of materials such as bricks, powders and pastes prepared from diatomite (a sort of fossil meal or powder), which possesses the peculiar quality of resisting the passage of heat through it. We perceived the possibilities of this business at an early date, and the brick we sell under the brand Insulite is well and favourably known.

So remarkable are the savings to be effected by building a layer of these bricks behind the firebricks which come in actual contact with the heat used that we foresee endless possibilities before this branch of our business and are devoting special attention to its development. We feel we have hardly touched the fringe of its immense possibilities, and we know there is a vast field of usefulness and profit rapidly developing for us.

It is no exaggeration to say that there are annually wasted through the absence of heat insulation millions of tons of coal, which might just as well be thrown into the sea for all effective use they are. Who that knows the effect of a tea-cosy on a teapot—and who doesn't?—can doubt that a coat of insulite brick on a furnace or an oven will retain, to do its proper work, the heat now too often allowed freely to perish expensively in an effort to warm up the surrounding atmosphere.

The "Dreadnought."

I mentioned a new fire-resisting brick we had introduced, appropriately named the "Dreadnought," for he is a very Dreadnought of a fellow, who spurns the fiery furnace like Shadrach, Meshach and Abed-nego, and is happiest where the flames are hottest! He is a stout, strong fellow, who regard hard usage, rough handling and sudden changes of temperature with equal contempt, and we know there are a hundred opportunities for this brick as soon as we can see our way to introduce it on a commercial scale.

The continual advance of powdered fuel firing, for example, finds an immediate opening for it, and it will be of immense service to those industries which use high temperature furnaces for steam production. You will be interested to know that we have joined with others, in the control of a wide acreage containing the raw material from which this brick is mainly produced, and that our future supplies are definitely assured.

We anticipate important profits from the exploitation of this mineral, in addition to those derived from the sale of the brick, which you will be glad to hear is an all-British production. It is made from minerals derived entirely from these islands, and not only will its extended use render further importation of high alumina firebricks from the Continent entirely unnecessary, but there is every expectation that we shall be able to export it in considerable quantities.

We also look to our continuously successful speciality "Pyrolyte" to do better and better for us in the future. To say that this fire cement, which will stand any commercial heat, and sets cold on the ends of two firebricks so hard and strong and tight that the joint will bear the weight of an average man, is unique, is an understatement, and as the cement becomes more widely known we are certain it will be in ever greater demand. We have several other profitable novelties and specialities ready for development as soon as time and funds permit.

Developments at King's Lynn.

We told you in our report of the developments at King's Lynn, where we have acquired a large acreage of freehold sand-bearing land, and erected thereon a commodious electrically-driven new plant of a very complete and efficient character. This commenced work early this year, so did not benefit the period under consideration to-day, but it has reduced costs considerably and is helping us in other directions, as is also the modern re-equipment at Bramcote which, under Mr. Fisher, is one of the best-equipped and managed quarries in the country.

At the South Cave sand quarries, near Hull, has been erected a complete sand-milling and disintegrating plant of the most efficient kind, and of this the Lord Mayor of Hull was kind enough to perform the opening ceremony the week before last. A number of prospective users of the product were present (along with the Sheriff of Hull) at the subsequent luncheon, and all spoke very highly of the enterprise.

We anticipate a substantial yield from this expenditure, which will, in our opinion, enable us to set at defiance a great deal of the foreign competition in moulding sands.

Similar equipment is now due at Kidderminster and at other of our quarries, and will be proceeded with as soon as circumstances permit.

Folly of the National Financial Policy.

Such developments, however, call for a consideration of ways and means, and it is when we come to that point that we see the disastrous folly of our national financial policy. Do you realise that for every pound of our profits that we lock up in extensions designed to help meet foreign competition and increase exports we have to find the Government 4s. 6d. in cash? An ill-equipped inefficient concern that makes no profits pays no tax at all—hence the income-tax is nothing more nor less than a fine levied on those who are enterprising and efficient.

No such conditions prevail in any other country of the world, and it is high time we saw an end of them here. Is there any wonder that British re-equipment proceeds so slowly, and isn't it quite obvious the Government ought to find its revenue from a tax on imported goods, instead of those produced at home, leaving absolutely untaxed that portion of the profits which is spent on re-equipment?

The present ridiculous system of piling burden after burden upon British industry is slowly but surely strangling the goose that lays the golden eggs, and there have been far too many industrial geese who have suffered death from misadventure during recent years.

Silicosis Regulations.

Take, for instance, the burden of the silicosis regulations, a charge upon the silica brick industry for the prevention of silicosis, and the formation of a fund from which to compensate workers who suffer from that complaint.

This, clearly and definitely, makes silica bricks more costly—everybody concerned knows that—and yet it will hardly be believed that Continental silica bricks made under conditions absolutely illegal here are permitted free entry into our ports to compete with our own products. The refractories industry demands fair play and calls for the imposition on all

(*Continued on page* 372.)

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MANUFACTURERS & PRODUCERS OF REFRACTORY MATERIALS OF EVERY DESCRIPTION. BRICKMAKERS · QUARRY AND MINEOWNERS CONTRACTORS & EXPORTERS.

GENERAL REFRACTORIES LIMITED

Incorporating THE GENERAL REFRACTORIES CO. LTD. THE MIDLAND REFRACTORIES CO., LTD. THOMAS BROOKE & SONS LTD. WORKSOP BRICK CO., LTD. GUISELEY SILICA CO. LTD.

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We should like you to read the report of our Annual General Meeting, which appears — in this issue. —

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—The continued depression, now almost worldwide, in the pig-iron industry is reflected in the weekly attendances in the Cleveland markets, which of late have convincingly evidenced a complete absence of interest in this once all-important staple product of the North-East area. With all the desire in the world to discover an alleviating feature in the present prospects of the trade, it is impossible to avoid the conclusion that business in pig-iron is almost at a dead end, both at home and for export, making it extremely difficult to maintain the limited number of furnaces now in blast on Tees-side at full productive strength, and this notwithstanding that prices have been cut to the limit; indeed, every ton of iron sold in this district has been made at a loss, yet still Midlands iron is coming in at low prices, occasional cargoes of foreign iron arrive in the Tees, and in Scotland Cleveland iron has been largely shut out by the competition of cheap foreign iron. In the difficult position of the trade thus briefly outlined, it is not surprising that Cleveland ironmasters are rigidly adhering to the recently-reduced prices, as follow:—No. 1 Cleveland foundry iron, 70s. per ton; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; No. 4 forge, 66s. per ton.

In the market for North-East Coast hematite, the situation is little, if any, better than the conditions applying in the foundry iron section, with demand on a diminished scale, and stocks at works accumulating to an extent that will take a long time to liquidate. Meanwhile, makers are scouring the market for orders, and whilst 74s. is the quoted figure for small parcels, it is well understood that this price would be cut for a substantial order. No. 1 quality is at a premium of 6d. per ton. On the North-West Coast, Bessemer mixed numbers are quoted at 75s. 6d. at works.

LANCASHIRE.—In common with other consuming districts, demand for foundry pig in this area continues somewhat spasmodic, with very few forward transactions coming under observation. Consumers generally appear to be marking time, pending a further reduction in Midland furnace prices, which it is confidently expected may shortly materialise. Quotations therefore remain so far unchanged, No. 3 Derbyshire and Staffordshire offering at 77s. and Scotch makes at about 95s., all per ton delivered local stations.

THE MIDLANDS.—It is satisfactory to report that some consuming trades in the Black Country are a little better situated for work, but in the main trade is quiet and the immediate prospects are not reassuring. Ordinary foundry numbers are being quoted at the minimum zone levels, namely, 75s. for Northants No. 3 and 78s. 6d. for Derbyshire and North Staffordshire No. 3, delivered to local stations in each case.

SCOTLAND.—There is no improvement to report in the state of the Scottish pig-iron trade. Business continues to be exceedingly quiet, and founders generally seem to be very short of work. In the light-castings section most of the works are only able to operate three or four days per week, and it looks as if this condition would continue for an indefinite period. The price of Scotch foundry is maintained by the makers at 78s. for No. 3, f.o.t. furnaces, in spite of the lack of demand.

Finished Iron.

Business in this section of the manufacturing trade continues quiet. It is only in connection with Staffordshire marked bars that there is any activity. These bars are still quoted at £12 10s. at works, and makers are comfortably situated. There is much competition for crown bars, the price of which is from £10 to £10 7s. 6d. Orders, however, are lacking in tonnage, and the makers are unable to keep their mills regularly occupied, spasmodic working being the rule rather than the exception. With regard to nut and bolt iron, the local makers are getting only spot lots, as the bulk of the business emanating from the makers in the Darlaston district is going to the Continent, where very low prices prevail.

Steel.

Although still on a restricted scale, the demand for semi-products has improved somewhat, and there have been fair purchases of Continental material. The British works, however, continue to take a good share of this business in districts where they are prepared to compete for orders. At Sheffield this week acid steel billets attract less attention, and the demand for basic billets is also tapering off rather seriously. Orders for stainless and special steels keep up, but there is a sharp slump in the cheaper qualities. The output of open-hearth steel will have to be curtailed if order-books do not speedily show a different aspect, for at present there is a heavy shrinkage of bookings. Wire rod makers are feeling the effect of competition from the Continent to an increasing degree. Prices:—Siemens acid billets, £9 10s.; basic billets, soft, £6 10s.; medium, £7 12s. 6d. to £8 2s. 6d.; hard, £9 2s. 6d. to £9 12s. 6d. In the tinplate market current quotations for coke quality rule at 18s. 3d. to 18s. 6d. basis, net cash, f.o.b. Welsh ports.

Scrap.

Reports from the various centres of consumption of foundry scrap material indicate little improvement in trade conditions, while stocks everywhere are accumulating in the absence of any buying movement in prospect. On the North-East Coast, however, heavy cast iron still maintains its value fairly well, ordinary quality being now quoted at 59s. 6d. and good machinery quality at 62s. 6d. per ton. In Scotland the cast-iron scrap market is unchanged. Heavy machinery cast-iron scrap, suitable for foundries, is quoted 67s. 6d. to 68s. 6d., ordinary cast iron 62s. 6d. to 63s. 6d., steelworks cast iron 60s., light cast iron 55s., and firebars 52s. 6d. to 53s. 6d. The above prices are all per ton, delivered f.o.t. consumers' works.

Metals.

Copper.—Movements in last week's markets for base metals disclosed a further downward tendency in values, and in the case of warrant copper touched the lowest level recorded during the present century. The market is consequently nervous and unsettled, and although it is only to be expected that more interest will be attracted by the present low prices, buying is still very spasmodic. The fact is, that many consumers have come to the conclusion that, if the pegged price in America can fall once, there is nothing to prevent it falling again.

Closing quotations :—

Cash.—Thursday, £49 17s. 6d. to £50 2s. 6d.; Friday, £51 5s. to £51 7s. 6d.; Monday, £55 12s. 6d. to £55 15s.; Tuesday, £57 17s. 6d. to £58 2s. 6d.; Wednesday, £56 5s. to £56 10s.

Three Months. — Thursday, £49 17s. 6d. to £50; Friday, £51 3s. 9d. to £51 5s.; Monday, £54 12s. 6d. to £54 15s.; Tuesday, £57 15s. to £57 17s. 6d.; Wednesday, £55 17s. 6d. to £56.

Tin.—A similar reactionary movement in values also developed in the market for standard tin, which early last week receded to £142 7s. 6d., the lowest figure recorded since 1922. This was followed by a partial recovery, but the market remains in a very irregular condition. According to the April statistics, America is well supplied with tin. Fresh American buying, therefore, cannot be expected, and suggestions of the American consumption decreasing still further are most disquieting. This slump has taken place despite the restriction scheme, which is understood to be operating successfully.

Official closing prices :—

Cash.—Thursday, £145 10s. to £145 15s.; Friday, £145 2s. 6d. to £145 5s.; Monday, £145 7s. 6d. to £145 12s. 6d.; Tuesday, £150 2s. 6d. to £150 7s. 6d.; Wednesday, £149 2s. 6d. to £149 5s.

Three Months. — Thursday, £147 5s. to £147 7s. 6d.; Friday, £146 12s. 6d. to £146 15s.; Monday, £147 5s. to £147 7s. 6d.; Tuesday, £151 15s. to £151 17s. 6d.; Wednesday, £150 17s. 6d. to £151.

Spelter.—The price of spelter has been very erratic recently, and frequent falls in value have been registered. Consumption is poorer now than it has been for some time, and it would appear that consumers have almost completely retired from the market.

Daily quotations :—

Ordinary.—Thursday, £16 8s. 9d.; Friday, £16 8s. 9d.; Monday, £17 12s. 6d.; Tuesday, £17 2s. 6d.; Wednesday, £16 10s.

Lead.—In sympathy with other metals, the market for soft foreign pig has been very weak for some time past, and the general feeling of uncertainty persists.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £17 10s.; Friday, £18; Monday, £18 7s. 6d.; Tuesday, £18 10s.; Wednesday, £18 5s.

General Refractories, Limited.

(*Continued from page* 370.)

imported refractories of a duty at least equal to the difference between the burdens on British manufactures and those made abroad. What is the good of expensive regulations for protecting the worker against losing his health in his job when those very regulations cause him to lose the job itself?

How, on the other hand, can you help increasing unemployment by such a policy? So long as it is pursued, every fresh burden imposed in the hope of bettering the condition of the workers put some more of them out of employment. Why, we are caught in the maelstrom of a vicious circle, from which there is no escape but a duty high enough to protect the goods produced by the worker against the competition of those whose social standard is lower than our own, and who can consequently produce more cheaply.

Four Inflexible Principles.

The following are four inflexible principles which govern the company's activities :—

(1) To keep itself informed of all discoveries and improvements in and in connection with the manufacture, marketing and use of refractories, and to utilise in its business all such information at the earliest possible moment.

(2) So to equip itself that it may always use the latest and most economical plant and processes for the production of the very best goods at the lowest possible cost.

(3) To carry on its business primarily with a view to providing the consumer with the goods that will best help him to do his own work in the most efficient way, so that he will have no good reason for not using the company's products regularly.

(4) To purchase, whenever possible, goods produced at home, and to advocate at all times the purchase of British goods, and particularly British refractories.

The company realises, and tries to make its customers realise, that a Briton out of work is a Briton who has definitely to be maintained at the cost of British industry, but that in the case of a foreigner we can please ourselves.

Confidence in the Future.

I have said nothing about the special difficulties of the year 1929, because you are as well acquainted with them as I am; but it is a fact that we can do a lot better when we can concentrate on our proper work of making and selling refractories, and I expect that after the issue of the new capital we shall really be able to "get right down to it" for our mutual benefit. We have had the most loyal and self-denying service from every member of the staff, which works together as one man (including the ladies, God bless them!), and I feel that this trying year has reinforced the bonds which hold us together and strengthened the position of the company, for there are few of them who are not shareholders. We know it is not in mortals to command success. All we can do is to deserve it, and this is our continual aim. We regard the future with confidence and determination to carry out the policy outlined to you.

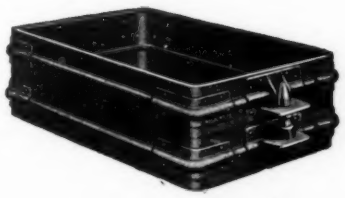
I now have pleasure in moving that the report and accounts, as presented, be received and adopted, and that the recommended dividend of 12½ per cent. be paid.

The resolution was seconded by Mr. R. W. Matthews, J.P., and carried unanimously.

The retiring directors were re-elected, and Messrs. Holmes, Widlake & Gibson having been re-appointed auditors, the meeting closed with a hearty vote of thanks to the staff.

Sterling

SOLID RIBBED ROLLED STEEL MOULDING BOXES



are recognised as standard box equipment by the leading foundries and engineering establishments in this country and overseas.

Because they speed up production, save unnecessary labour, produce accurate castings and make for all-round efficiency in the foundry.

STERLING BOXES WILL SAVE THEIR COST IN A FEW MONTHS.

WRITE FOR CATALOGUE No. 37.

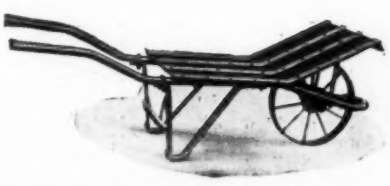
Sterling

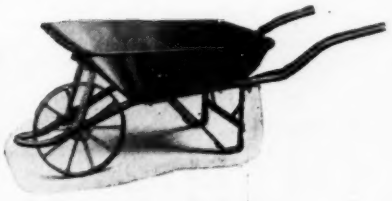
FOUNDRY BARROWS

for

SAND, COKE, and PIG-IRON

are sturdily built to withstand the heavy duties and harsh treatment of the severest foundry service.





STERLING FOUNDRY SPECIALTIES LTD.

London Office:
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BEDFORD.

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Telegrams: "STERFLASK, BEDFORD."
Code: WESTERN UNION.

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Newcastle-on-Tyne: LAWSON, WALTON & CO., LTD., Handyside Arcade, NEWCASTLE-ON-TYNE.
Manchester: F. L. HUNT & CO., Chapel Street, SALFORD, MANCHESTER.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	56	5	0
Three months	55	17	6
Electrolytic	60	0	0
Tough	58	10	0
Best selected	59	0	0
Sheets	87	0	0
India	71	0	0
Wire bars	61	7	6
Do. June	61	7	6
Do. July	61	7	6
Ingot bars	61	7	6
H.C. wire rods	63	12	6
Off. av. cash, April	62	3	3¾
Do., 3 mths., April	61	4	10⅞
Do., Sttlmnt., April	62	3	7½
Do., Electro, April	75	1	0
Do., B.S., April	68	10	3⅛
Do., wire bars, April	75	15	3
Aver. spot price, copper, Apr.	62	3	3¾
Solid drawn tubes			12¼d.
Brazed tubes			12½d.
Wire			8½d.

BRASS.

Solid drawn tubes	11d.
Brazed tubes	12⅝d.
Rods, drawn	10⅝d.
Rods, extd. or rlld.	6¾d.
Sheets to 10 w.g.	9⅜d.
Wire	9⅜d.
Rolled metal	8⅞d.
Yellow metal rods	6⅜d.
Do. 4 × 4 Squares	7½d.
Do. 4 × 3 Sheets	7⅜d.

TIN.

	£	s.	d.
Standard cash	149	2	6
Three months	150	17	6
English	150	5	0
Bars	153	5	0
Straits	152	2	6
Australian	151	2	6
Eastern	150	0	0
Banca	157	2	6
Off. av. cash, April	162	14	7½
Do., 3 mths, April	164	15	2½
Do., Sttlmt., April	162	14	9
Aver. spot, April	162	14	7½

SPELTER.

	£	s.	d.
Ordinary	16	10	0
Remelted	16	0	0
Hard	14	10	0
Electro 99.9	19	10	0
English	17	12	6
India	15	10	0
Zinc dust	22	10	0
Zinc ashes	4	5	0
Off. aver., April	18	1	11⅛
Aver., spot, April	17	16	4½

LEAD.

	£	s.	d.
Soft foreign ppt.	18	5	0
English	19	15	0
Off. average, April	18	6	9¾
Average spot, April	18	6	4½

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	27	0	0
Do. V.M. ex-whf.	26	0	0
Rods	29	0	0
Boiler plates	24	0	0
Battery plates	24	10	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	40	0	0
Chinese	28	0	0
Crude	20	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	12	6

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	7	15	0
45/50%	11	10	0
75%	18	10	0
Ferro-vanadium—			
35/50%	12/9 lb. Va.		
Ferro-molybdenum—			
70/75% c. free	4/2 lb. Mo.		
Ferro-titanium—			
23/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£16	0	0
Ferro-tungsten—			
80/85%	2/10 lb.		
Tungsten metal powder—			
98/99%	3/1 lb.		
Ferro-chrome—			
2/4% car.	£30	10	0
4/6% car.	£23	7	6
6/8% car.	£22	10	0
8/10% car.	£22	0	0
Ferro-chrome—			
Max. 2% car.	£33	10	0
Max. 1% car.	£37	12	6
Max. 0.70% car.	£39	0	0
70% carbon-free	11d. lb.		
Nickel—99% cubes, or pellets	£175	0	0
Ferro-cobalt	9/7 lb.		
Aluminium 98/99%	£95	0	0
Metallic chromium—			
96/98%	2/7 lb.		
Ferro-manganese (net)—			
76/80% loose	£11	15	0
76/80% packed	£12	15	0
76/80% export	£11	10	0
Metallic manganese—			
94/96%, carbonless	1/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	£	s.	d.
Finished bars, 14% tungsten	£0	2	2
Finished bars, 18% tungsten	£0	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to $\frac{3}{16}$ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	3	1	0	to	3	2	6
Bundled steel and shrngs.	2	17	0	to	3	0	0
Mixed iron and steel	2	16	0	to	2	18	0
Heavy cast iron	2	16	0	to	2	18	0
Good machinery for foundries					3	0	0
Cleveland—							
Heavy steel					2	12	6
Steel turnings					2	10	0
Cast-iron borings					2	2	6
Heavy forge					3	10	0
W.I. piling scrap					3	5	0
Cast-iron scrap	2	19	6	to	3	2	6
Midlands—							
Ord. cast-iron scrap					3	2	6
Heavy wrought					3	12	6
Steel turnings					1	15	0
Scotland—							
Heavy steel					2	19	0
Cast-iron borings					2	8	6
Wrought-iron piling					3	18	0
Heavy machinery					3	8	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	48	0	0
Brass	35	0	0
Lead (less usual draft)	16	0	0
Tea lead	12	10	0
Zinc	9	0	0
New aluminium cuttings	62	0	0
Braziery copper	45	0	0
Gunmetal	45	0	0
Hollow pewter	110	0	0
Shaped black pewter	82	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	70/-
Foundry No. 3	67/6
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1	74/6
Hematite M/Nos.	74/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	85/6
„ d/d Birm.	93/6
Midlands—	
Staffs. common*	—
„ No. 4 forge*	73/6
„ No. 3 fdry.*	78/6
Shrops. basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	70/-
„ fdry. No. 3*	75/-
Derbyshire forge*	73/6
„ fdry. No. 3*	78/6
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	80/6
„ No. 3	78/-
Hem. M/Nos.	81/-
Sheffield (d/d district)—	
Derby forge	67/6
„ fdry. No. 3	72/6
Lincs. forge.	70/-
„ fdry No. 3	75/-
E.C. hematite	89/-
W.C. hematite	90/-
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	72/-
„ fdry. No. 3	77/-
Staffs foundry No. 3	77/-
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	95/-
Glengarnock, No. 3	—
Gartsherrie, No. 3	95/-
Monkland, No. 3	95/-
Shotts, No. 3	95/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)					10	15	0
Nut and bolt iron	9	0	0	to	9	7	6
Hoops					10	15	0
Marked bars (Staffs) f.o.t.					12	10	0
Gas strip					10	15	0
Bolts and nuts, ¾ in. × 4 in.					15	5	0
Steel—							
Ship plates	8	15	0	to	8	17	6
Boiler plts.	9	17	6	to	10	10	0
Chequer plts.					10	12	6
Angles					8	7	6
Tees					9	7	6
Joists					8	10	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¾ in. (Untested)					8	2	6
							and upwards
Flats—8 in. wide and over					8	12	6
„ under 8 in. and over 5 in.					8	17	6
Rails, heavy					8	10	0
Fishplates					12	0	0
Hoops (Staffs)	9	5	0	to	9	15	0
Black sheets, 24 g.					9	15	0
Galv.cor.shts., 24g.					11	17	6
Galv. fencing wire, 8g. plain					12	0	0
Billets, soft	6	0	0	to	6	10	0
Billets, hard	7	10	0	to	8	0	0
Sheet bars	5	15	0	to	6	5	0
Tin bars	5	15	0	to	6	5	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/1½
Sheet to 10 w.g.	1/2
Wire	1/3½
Rods	1/2½
Tubes	1/6¾
Castings	1/1½

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/5
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.00
Basic	20.26
Bessemer	20.76
Malleable	20.76
Grey forge	19.76
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	43.00
Billets	33.00
Sheet bars	33.00
Wire rods	38.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.75
Tank plates	1.75
Beams, etc.	1.75
Skelp, grooved steel	1.85
Skelp, sheared steel	1.85
Steel hoops	2.20
Sheets, black, No. 24	2.55
Sheets, galv., No. 24	3.30
Sheets, blue an'l'd, No. 13	2.15
Wire nails	2.15
Plain wire	2.30
Barbed wire, galv.	2.95
Tinplates, 100-lb. box	$5.25

COKE (at ovens).

Welsh foundry	27/6 to 30/-
„ furnace	17/6 to 22/6
Durham and Northumberland—	
„ foundry	15/6
„ furnace	15/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box		18/4½
„	28×20 „		36/9
„	20×10 „		26/4½
„	18½×14 „		19/1½
C.W.	20×14 „		16/6
„	28×20 „		33/9
„	20×10 „		23/6
„	18½×14 „		17/-
Terneplates	28×20		32/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-Iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	17	6	to	£16	15	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods dead soft, steel	£11	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ½ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
May	8 ..	49	17	6	inc.	30/-
,,	9 ..	51	5	0	,,	27/6
,,	12 ..	55	12	6	,,	87/6
,,	13 ..	57	17	6	,,	45/-
,,	14 ..	56	5	0	dec.	32/6

Electrolytic Copper.

		£	s.	d.		
May	8 ..	57	0	0	inc.	20/-
,,	9 ..	57	0	0	No change	
,,	12 ..	58	10	0	inc.	30/-
,,	13 ..	60	0	0	,,	30/-
,,	14 ..	60	0	0	No change	

Standard Tin (cash).

		£	s.	d.		
May	8 ..	145	10	0	inc.	5/-
,,	9 ..	145	2	6	dec.	7/6
,,	12 ..	145	7	6	inc.	5/-
,,	13 ..	150	2	6	,,	95/-
,,	14 ..	149	2	6	dec.	20/-

Tin (English ingots).

		£	s.	d.		
May	8 ..	146	10	0	inc.	5/-
,,	9 ..	146	5	0	dec.	5/-
,,	12 ..	146	10	0	inc.	5/-
,,	13 ..	151	5	0	,,	95/-
,,	14 ..	150	5	0	dec.	20/-

Zinc Sheets (English).

		£	s.	d.		
May	8 ..	27	10	0	No change	
,,	9 ..	27	0	0	dec.	10/-
,,	12 ..	27	0	0	No change	
,,	13 ..	27	0	0	,,	,,
,,	14 ..	27	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
May	8 ..	16	8	9	inc.	6/3
,,	9 ..	16	18	9	,,	10/-
,,	12 ..	17	12	6	,,	13/9
,,	13 ..	17	2	6	dec.	10/-
,,	14 ..	16	10	0	,,	12/6

Lead (English).

		£	s.	d.		
May	8 ..	19	0	0	inc.	5/-
,,	9 ..	19	10	0	,,	10/-
,,	12 ..	20	0	0	,,	10/-
,,	13 ..	20	0	0	No change	
,,	14 ..	19	15	0	dec.	5/-

Exports of Iron Castings in April and the four months 1930, compared with April and the four months 1929.

	April, 1929.	April, 1930.	Four months, 1929.	Four months, 1930.	April, 1929.	April, 1930.	Four months, 1929.	Four months. 1930.
BUILDERS' CASTINGS—	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Stoves, grates, etc., cisterns, baths, etc., and cooking and washing boilers—								
To Argentine Republic	84	133	687	791	2,769	6,228	32,444	32,311
,, British South Africa	260	118	1,216	764	9,333	4,692	42,884	30,309
,, ,, India	118	110	623	588	5,389	3,941	24,091	20,924
,, Australia	39	42	263	200	2,802	1,925	15,515	11,747
,, New Zealand	68	82	477	398	2,782	4,950	36,631	23,657
,, Other Countries	661	829	3,360	3,423	31,508	37,030	150,314	154,251
Total	1,230	1,314	6,626	6,164	54,583	58,766	301,879	273,195
PIPES AND FITTINGS—CAST—								
To Argentine Republic	358	1,546	11,762	5,218	2,982	13,569	113,772	49,288
,, British South Africa	844	571	2,163	3,687	8,258	6,682	28,071	39,460
,, ,, India	198	256	1,338	1,423	3,582	3,028	21,535	20,942
,, Straits Settlements and Malay States	1,748	527	8,988	2,220	12,352	4,952	64,382	21,551
,, Ceylon	133	54	364	289	1,429	918	3,950	3,822
,, Australia	619	87	2,119	459	6,252	1,393	21,447	7,754
,, Other Countries	6,353	8,578	19,617	30,934	71,805	95,070	224,595	340,219
Total	10,253	11,619	46,351	44,230	106,660	125,612	477,752	483,036
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	372	272	1,536	1,499	13,872	9,641	55,304	48,253
,, Enamelled	68	51	276	245	6,619	4,746	24,532	21,568
CASTINGS, in the rough—								
Iron	159	100	364	1,046	3,756	3,762	13,544	27,176
Steel	95	92	296	796	3,290	3,846	13,570	29,066

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